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AUTHOR Miller, Beth R.
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ABSTRACT

Eight units of instruction and four projects comprise a curriculum on the brain and information processing for fourth grade students. Units, which frequently involve a guest speaker, focus on intelligence and creativity, the appearance and mechanisms of the brain, the five senses, the art and science of perception, language, reading, a field research day at the Pacific Science Center, and, finally, a "brain-drain" fair for display of student projects. Projects include the keeping of a mind or dream journal, a class literary magazine, and a class scholarly journal. Each unit is described in detail. Included in the curriculum materials are 19 handouts of information for teachers or for use in instruction. (RH)

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Beth R. Miller
18 Round Lake Park Road
Monroe, NY 10950

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LEARNING: HOW THE BRAIN ACQUIRES INFORMATION

There is an element which is so basic to success in school and later life that it is the one most overlooked, or simply taken for granted. That is, how do we as individuals receive and process sensory information; or, how do we learn? This is a sizeable inquiry. However, an awareness of how we learn as individuals opens up a multitude of "doors" in terms of going beyond the original learning situation for all learners.

With this in mind, I thought it might be fun to put together a curriculum for elementary-school aged children concerning the brain and information processing. The course approach is intended to be in line with current mind-brain research, and thus is creative and wholistic. It is structured for a typical fourth grade classroom, perhaps 30-35 students about nine or ten years old. There are special, regular,and gifted education students. There would also be parent volunteers and a teacher aide or two as available. I must emphasize that this course is merely a blueprint for action, and is intentionally incomplete. Teachers and educators are encouraged to enlarge upon what is presented using their own creativity and ideas. Everyone should experience a growth as a result of this school-based undertaking.

The course is entitled, "Mind Adventuring: Learning About How We Learn." There is no fixed time period, and material has been organized into units for

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presentation. Let me quickly add that this is not intended to be the ideal fourth grade curriculum because I am not a trained teacher; this is merely a blueprint for action.

Take a deep breath as we enter into the realms of our minds.....

One week before the course is scheduled to begin, the teacher does some stage-setting. Students are asked to collect, or be on the lookout for, articles, books, reports, films, television programs, lectures, comic strips, etc. , that relates to INTELLIGENCE, CREATIVITY, LEARNING, the BRAIN. They will be given folders to collect their research in. Secondly, students will be asked to ease themselves into the mindset of thinking, or reflecting upon how we learn, how they learn as individuals; to think about intelligence and creativity and formulate some ideas as to what these are.

The day before the course starts, we talk about a 'cooperative learning environment' followed by our doing and participating in one. We adapt an operational code such as students will write their names in a designated area on the blackboard if they need help, wish to leave the room, etc. This code will be modified as needed if it doesn't work out. I will explain about the presence of learning, resource, and media centers in the class; individual, small group, and classroom learning activities; no textbooks or workbooks, etc. The "face" of our normal classroom is about to change. Students get up and push their desks over to one side. Out come throw pillows, beanbag chairs, afghans, etc. Bowls with raisins, nuts, sunflower seeds are spread around. There are several pitchers of fruit juices. The students seat themselves comfortably on the floor (hopefully, carpeted), and are directed to shake out their limbs and get their blood flowing. This will be our laboratory for learning, experimenting, and adventuring in.

The students are given course outlines so they have some idea as to what to expect, and can generate some excitement:

"Mind-Adventuring: Learning About How We Learn"

UNIT #1: Let's Talk About Intelligence and Creativity -- What Are They?

Guest Speaker - Prim, fashion designer

UNIT #2: What do our Brains Look Like, and How do They Work?

- Surprise -

UNIT #3: The Five Senses - Our Gateway to the World

What, then, is Learning? Brain Integration

UNIT #4: The Art and Science of Perception

A. How do We See? Guest Speaker - Julie, who is blind, and how she sees.

B. How do We Hear? Guest Speaker - Warren, chemist, and vibration analysis.

UNIT #5: "Use It or Lose It" or, What is Language all About?

Guest Speaker - Heidi, polylinguist

UNIT #6: What Goes into Reading?

UNIT #7: Field Research Day - AM, Pacific Science Center - exhibit on creativity
PM, Federal Way Convalescent Center

UNIT #8: Brain-Drain Fair for School and Parents followed by class pizza party.

The students already know there is no textbook, and are told that we will be writing and creating our own textbook as we go along. They have their "data-collection" research folders.

There will be several ongoing projects:

a. Mind journal or dream journal - students are asked to make at least one entry per evening in their private journals, can be anything relating to overall theme and can take any media form (picture, collage, quote, story, poem, song, a creation, skit, floor-plan...whatever); in the dream journal students are instructed to keep a pad and pen by their beds and to record their dreams. Students may do either journal option, or alternate between the two.

b. Class literary magazine - each student will submit to our student editorial committee as many entries as they like, the committee will choose one selection per student-compile- and produce a classroom literary magazine copy for all class members.

c. Class scholarly journal - instead of (b) students may wish to submit brief essays on issues related to general theme for inclusion in a class-produced "Journal of Learning: or "The Journal of Intelligence and Creativity," etc.

d. Brain-Drain Fair exhibits and demonstrations - students need to commit as soon as possible, and they can then direct their independent coursework to completing Brain-Drain projects. There should be a handout explaining the fair and learning activities. An example follows - - page 5.

The students will be given feedback forms at the end of every class to express how they are feeling about the course, what they like and dislike, suggestions, modifications, deletions, etc.

WELCOME TO "MIND-ADVENTURING" OR LEARNING ABOUT HOW WE LEARN

Our final project is going to be a 'BRAIN-DRAIN' fair that we will stage for the school and your parents (brothers and sisters, even grandma and grandpa can come too!) on _____DATE_____.

Be thinking about <u>WHAT</u> you would like to do, and <u>WITH WHOM</u> you would like to work with. You can do as many things as you like. Show off your talents, creativity, and pizazzzz....

Here are some ideas and suggestions (remember, it's usually more fun when you come up with your own ideas).

* a three-dimensional model of the brain
* a bas-relief or regular brain-map
* around-the-room mural on perception, reading, language acquisition
* a photography exhibit
* a bulletin board on intelligence and creativity
* a learning center on optical illusions
* individual reports that will be displayed in our class library
* models of perception (visual, auditory, tactile, olfactory, taste)
* demonstrating visual-auditory-motor measures
* role-playing or dialogues or short skits on selected topics
* a videotape
* a panel discussion - either students participate or arrange for guest panelists
* a debate or a game show reinactment

We also need a group of students who will participate in the fair-planning executive committee. Includes making arrangements for the pizza party!

The class will understand that their final projects and course evaluations are due on the last day of the course which is "BRAIN-DRAIN" day. Course evaluations and self evaluations will be handed out prior to the final day, and each teacher/class should design their own. There will be no grading during the course, but students will receive feedback on their work and progress. *<u>Students will not be checked out for completed assignments, but it is expected that they will participate; pace their learning; make intelligent choices based upon how</u>

they learn best and complete a final project for our fair. They are expected to either verbally state, or have in written form, an individualized learning profile at the end of the course. *Naturally, there should be sufficient support staff (aides and volunteers, interns, parents, etc.) to facilitate helping each child work towards increasing independence and solid decision-making. Otherwise, this course falls flat on its face! Assuming that a letter grade will have to be assigned, this should be a joint-evaluative venture between teacher(s) and student.

As a preparatory exercise, students are now asked to reflect upon (1) INTELLIGENCE and (2) CREATIVITY (for a few minutes) and (1) write down all those things that immediately pop into their minds [guided brain-storming] and (2) then write a few sentences describing their ideas and thoughts about Intelligence and Creativity. Their reflections will be collected, compiled, and presented at the beginning of the class. This will introduce us to:

"MIND-ADVENTURING"

Home Activities: (1) At least one entry in mind or dream journals, (2) continue data-collections with research manila envelope, (3) thing about BRAIN-DRAIN project and literary magazine submissions (just think, no doing), (4) look over handouts on brain structure (teachers-remember to hand these out!), (5) think "BRAIN" and talk about it with friends and family - you'll impress them.

Today is the first day of the course. By way of introduction, we will do some exercises in creativity such as cross-sensing (tasting Tuesday, smelling blue, etc.) imaging to a musical selection, free-association word pairs, riddles or brain-teasers, etc. This should get the class in a creative mood. After some brief limb-stretching, I will present the different ideas and concepts re: intelligence and creativity, and I will write this on a huge poster board which will remain posted throughout the course. We will then have a class discussion bringing

in the students ideas AND the ideas that have been presented in the articles and such they have been collecting. [NOTE: homework assignment tonight is to make up a quiz on one piece of literature they have collected , tomorrow students will switch quizes and work on answering questions in small groups of two's or four's]. I will play devil's advocate and present the views of Piaget, a developmental psychologist, and Ulric Neisser, a cognitive psychologist (Psychology Today, May 1983, "A Conversation with Ulric Neisser"). We'll talk about Piaget's stages of learning (see Handout #1), Neisser's outlook on IQ measure and school, and Sir Cyril Burt's views on IQ and race ("British Psychologist Was a Knight, A Genius, Influential, and a Fraud," Spectator, December 1978). This should spur some lively discussion about the limitations of testing; how intelligence transcends a testing situation, and how the definition of intelligence and the labeling of success can have sociopolitical and economic underpinnings. The point of this lesson is to emphasize the beauty of individual differences and the incredible creative potential within all of us that is our intelligence; that we can and should be all that we can be because each of us has it all (lead into later discussion of Karl Pribam's hologram theory). We will conclude by taking a sample intelligence test, evaluating how we did, critiquing the test, and seeing how we could devise a better test. [NOTE: interested sudents may design their own intelligence tests as a substitute homework assignment, or journal entry, or longer-termed project for "BRAIN-DRAIN"].

It should be lunch time about now-maybe dinner time! When we reconvene, we are introduced to a Thai friend of mine, Prim, who was a London fashion designer. She will illustrate how her creativity and intelligence interact to produce beautiful styles and patterns of clothing. The students will have a chance to try their hands at designing a fashion.

Homework Assignments: (1) prepare a quiz or intelligence test sample, (2) at least one journal entry, (3) keep thinking about BRAIN-DRAIN project, (4) take time to think about what we did today in class, talk about it to others, (5) review handouts on brain structure, (6) do anything you want to do not mentioned that you are interested in relating to the course.

Two other daily events will include a "vocabulary tree" where we hang and add a new word on an ex-Christmas tree in the corner, AND a newscaster report on mind-brain current events from data-collection files (students take turns).

This Day is #2 or Unit #2. We'll start off with student's name Reports Live from classroom or school location and hear about some current research or data! Next we hand a vocabulary word on the tree. Then there are small groups who work on quiz and/or intelligence tests exchanges. But what is the surprise, someone asks. Okay, okay, get on walking shoes and turn on all sensory processing machinery upstairs. We are walking over to nearby university/community college where a nice young resident neuropsychologist will talk about the brain and how it is "made" to acquire learning (too-o-o convenient, I know!). We will look at the brain models AND embalmed brains on display, and we will examine the handouts on the physiology and anatomy involved in sensory (visual, auditory, etc.) processing. Question and answer period followed by lunch on a lawn, or in school cafeteria.

Following lunch, I will do a didactic presentation on "Specializations of the Human Brain" (Scientific American, September 1979, Norman Greschwind). We will start off by identifying what neurons, axons, dendrites, synapses, nerve cells are. We will then talk about right and left hemispheres and what specific activities are associated with each. We will take a look at Broca's

and Wenicke's areas to understand a bit about the comprehension of language and production of speech. We will touch upon cases of brain injury and how the brain compensates or adapts to the loss of some of its functioning units, i.e., brain plasticity. We will also look at the phenomenon of dyslexia and the abnormal cellular structure in the brain. We can then entertain some "how cum (How come)?" questions and answers, or how does a negative-to-survival condition not get selected out through the life species generations (an explanation about natural selection will be needed first)? We shall conclude this presentation with Handouts #2, #3, #4. which will stress brain integration through analogy.

Homework Assignments: (1) Vocabulary tree and live reports, (2) journal entry, (3) tomorrow we commit to a Brain-Drain project (expanded work on bas-relief brain models, diagrams of speech production and language carticulation, demonstrations of brain injury/recovery/compensation such as with stroke victims, an exhibit on what areas of brain control what areas and functions, dialogue between left and right brain hemispheres, etc.), (4) think about how our brains acquire information, then talk about it.

This is Day #3 or Unit #3: The Five Senses-Gateway to the World.

We start off with our vocabulary tree-hanging exercise followed by a student "live report." The studentsare then asked to write down some of their thoughts concerning BRAIN-DRAIN projects. Next is a "blizzard of paper" or Handouts #4 & #5. We put the handouts under something for now. Students are placed in groups of 4 or 5, assignment is to reinact either 1) the model of brain functioning as described by Joseph Chilton Pearce in Magical Child,* or 2) make up their own model and reinact that.

* See Handout #3- Brain Structure

The teachers can approach this unit from a wide variety of prespectives and activities. What follows is a list of suggested activities and exercises as a springboard for individualized adaptation to specific classrooms.

Along the societal dimension, you can arrange a field trip or volunteer experience that will permit the students to interact in the community. Unit #7- Field Research Day - has the students visiting a convalescent home and doing some research on brain injury-recovery-compensation.

For the intuitive dimension, it would be fun to have a detective or investigator kind of person come in as a guest speaker and address how their "hunches" aid them in their work and work-related safety. In addition, there are Guided Fantasy Journeys (pretend you are going through time and space from 1800 to present time, pretend you are a nerve cell traveling through the body, pretend you are a spool of thread being used to make a coat, etc.); Dream Journal(recording dream imagery-events-feelings →no interpretation!) →can be used as a basis for an art project, creative writing, research, self-understanding; Creativy Exercises (cross-sensing, brain-storming, poetry-writing in shapes --> examples follow:

1. What does it feel like to be a misspelled word? empty paper bag? crushed up milk carton? a new book? an old proverb? musical note? striped piece of fruit-flavored gum?
2. What number represents you? is happy? is sad? parental? dry? sweaty? snobbish? timid?
3. List of all things that come in pairs?
4. Make up a list of distantly related wordpairs →ask students to supply a third word to relate the first two.
5. Trash archeology - collect waste from at least three locations at the end of the day; reconstruct the day's events noting approximate times, events, possible antecedent and outcomes.

6. Writing poetry "Apollinaire" or the poetry lines assume the shape of its subject.

For the affective dimension, the teacher may consult values clarification and self-esteem building ideas' manuals. A self-advertisement exercise is fun where students are presented with dimensions (physical, intellectual, emotional, social, moral/spiritual), and are asked to draw or create an advertisement of themselves keeping the dimensions in mind. Another exercise is filling out a personal resume which lists successes/achievements/accomplishments from 0-5 years and 5-9 years. More suggestions can be found in Leland W. Howe, Ph.D., Taking Charge of your Life, Argus Communications, Niles, Illinois, 60648, 1977.

Other activities include:

1. Whose Hands - try to find partner's hands.
2. Taped Mysteries - identifying familiar sounds on tape
3. Listen Without Labeling - listen to inside → outside → as far as possible away from room ⇒ then reverse ⇐ as what is heard.
4. Tasty Turvey - tasting with eyes closed
5. Role-Playing different feelings - use costumes to signify mood changes.
6. Appreciation Circle
7. "What I Like About Myself" Collage
8. Human Machines
9. Mimed Mirrors
10. Pass the ball (book, umbrella, airplane, ice-cream cone, etc.)
11. Relaxation Activities

For the cognitive dimension, please refer to Handouts #7 & #8 for examples of classroom inquiry and group consensus problems that utilize the six areas of cognitive process as described on Handout #2. Brainstorming exercises are fun as are brain games which can be found in specific books dedicated to "tickling" the brain. The sky is the limit in programming here, and the teacher can use

the cognitive dimension in conjunction with teaching in a specific academic area such as social studies, language arts, humanities, etc.

Integrative activities of the above-mentioned dimensions which would also demonstrate brain integrative function are dancing/acting-out of multiplication tables, acting out the writing of a paragraph or report, learning a folkdance, multi-sensory imaging, etc.

The students should evaluate what senses are being used in the activities that they do, analyze the connection between sensory processing and learning, assess their individual learning styles, research which particular sensory experiences seem to result in the most efficient learning, and reflect upon how much of ourselves we take for granted.

Possible at home activities in addition to ongoing projects of journals (mind or dream), current events and vocabulary tree, brain drain projects include: tell the class or small group about a memorable sensory experience, memorize and recite a poem you have written, review the five senses with a friend, explain to your parents how the brain is structured to acquire learning ; identify how you learn best; do a report on E.S.P. for BRAIN-DRAIN, dramatize an extrasensory perception happening, practice identifying objects by their smell or feel, apply your knowledge of sensory processing by preparing a classroom teaching lesson, interview a sense, question others as to how they learn best, differentiate between sensory input and learning output, compare your experience of the world to someone else's, compose some questions that you have that have no answers, design some "sense-less" bumper stickers, rate how this unit made you feel.

Days 4 and 5 or Units 4 and 5 - The Art and Science of Perception, or How do we See, Hear, Touch, Smell, and Taste?

This will be a classroom day with a variety of demonstrations and activities. Our guest speaker is Julie, who is blind, and will talk about how she "sees." Another guest demonstrator will be a student, from our class or another, who will do magic tricks.

It is best to start off with vocabulary tree and current events report followed by a review of the preceding three units. Games such as Password, Jeopardy, and Trivial Pursuits constructed by students , parent volunteers, teacher aides are fun and effective ways to interact with and internalize the material. The teacher may also review by following up on the suggested homework activities in the previous units.

There will be a didactic presentation of information which the teacher may wish to include on a student handout.

(1) "More to Vision Than Meets the Eye," Jeanne McDermott, Smithsonian,1985.

a.intimate association of eye and mind, vision more than the process of mechanical recording of reality "just as it is," vision is not a single process.

b."What the Frog's Eye Tells the Frog's Brain," landmark paper published in 1959 by Jerry Lettvin, Humberto Maturana, Warren McCullock, Walter Pitts and M.I.T.

1) certain neurons in the frog's eye (big detectors) respond only to small dark objects moving through the frog's field of vision, neurons don't respond to particular quality of light but register differences in the distribution of light and dark impinging on the retina, each optic neuron telling brain about patterns - not just points of light frog's eye giving frog's brain information about the MEANING of what it is seeing → shows an ability to abstract information

that is built into the eye itself.

c. David Hubel - neurologist at Harvard Medical School and Torsten Wiesel, neurologist at Rockefeller University were among the first to ask how specific brain cells transform all the sensory information it receives.

1) they recorded the electrical activities of cells in monkeys' primary visual cortex; the more they probed, the more complex and specific became the cells' response.

2) all neurons respond to moving lines, but some neurons loved only lines of a given orientation AND some neurons loved only lines of a given orientation in a certain direction - → in 1981 Hubel and Wiesel earned Nobel Prize for their work.

Therefore, what we see depends a great deal on what we <u>think</u> we see; and/or what things mean to us, and how we understand our world.

Perception = Sensory Input + Meaning

d. Roger Sperry-psychologist at Caltech, won Nobel Prize in 1981

1) views brain as a mechanism for transforming sensory patterns' into patterns of motor coordination, the visual system and motor system are deeply intertwined -- "Where you see an object depends on input from almost every joint in the body."

2) the major work of the visual system is NOT to make visual copies of things perceived or imagined BUT rather to prepare the brain to respond to whatever the situation demands.

The students can now discuss their notions about visual perception, how they see, etc. At this point, the student magician can demonstrate that there is "more to vision than meets the eye." You may wish to quote Jerry Andrus, a magician, who asserts that, "You are taken in by magic because you know the way the world works."

And now, on to "The Perceptual World of the Child," from Learning to Use One's Senses, T.G.R. Bower, Harvard University Press, 1977.

Try this on for size: a mother whose 20 years old son was missing-in-action in Vietnam saw a film clip on television where a group of Vietnam soldiers were cleaning a barracks, she recognized the nose way off in the corner of the room as belonging to her son ....Howcum?

a. congenital blindness - seems possible that a complete loss of visual function is caused by a takeover of the "visual" areas of the brain by the other sensory modalities which are receiving sensory input.

b. seems that our perceptual system operates with DISTINCTIVE FEATURES rather than sense-specific items.

c. distinctive features allows the brain to construct accurate perceptions when there is insufficient or incomplete sensory input and/or through other sensory modalities if one (eyes, ears) is "shut down."

* Classroom Demonstration: replication of Ann Pick's experiment to explore concept and mechanics of 'distinctive features.' Please refer to Handout #1, Units 4/5. The experimental findings support the idea that perception does not operate with literal copies of inputs from the world, but rather with abstract distinctive features of the objects itself.

We remember things by choosing those properties of things that do not change. We call these properties that do not change DISTINCTIVE FEATURES. We use language to help us remember DISTINCTIVE FEATURES. We attach a name or label to each separate DISTINCTIVE FEATURE such as vertical, horizontal, curved, diagonal, etc.

f. Principles of Visual Perception, Carolyn Bloome-, NY., Van Nostrand Reinhold Pub. Co., 1976.

1) "seeing" is not a reason for "believing"

2) perceptual processes are not structured to record data, but rather to organize meaning.

3) an event is reconstructed - or remembered - from interwoven relationships with other memories.

4) perception is a series of automatic tentative judgments about probable meaning and relevance as extrapolated from limited data, streamlined for survival.

Pictures should be numbered

Classroom Demonstration - get hold of a collection of optical illusions and present to the class.

g. How We Remember What We See, Ralph Norman Haber, May 1970

1) seems like there is one kind of memory for pictures and another for language

2) recognition of pictures is essentially perfect

Classroom Demonstration - show students 40 different pictures at one second intervals (slides on a projector). Then slip in four new pictures. Have students write down which pictures are new after you show 40 + 4 new slides. Show slide - "#1" - one second-show slide - "#2" - one second etc.

3) recall of detail shows that pictures, faces, and other pictorial material stored in memory as IMAGES

* Classroom Experiment

a. divide class into two equal groups = A and B

b. within separate A and B groups students pair off in teams

c. show a selected picture (for about 60 seconds) to the entire class → in student teams each student draws and describes the picture to the other.

d. Group A plays a game for 30 minutes; Group B thinks about the picture and speaks whatever words come to mind for 30 minutes.

e. Both groups redraw picture (do not reshow picture) from memory

f. Compare Group A and B's pictures, discuss implications - memory is improved with practice and using words and pictures.

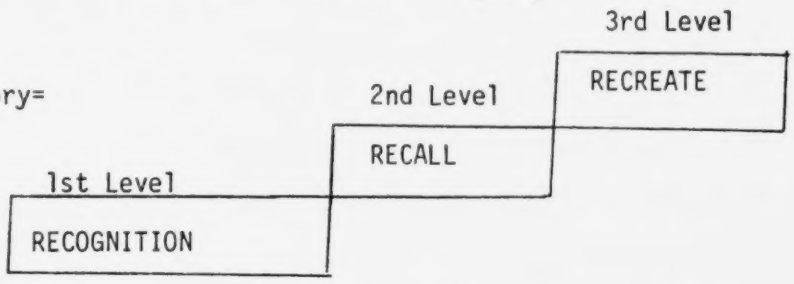
g. Collect all pictures to be placed on exhibit in the classroom.

4) much occurs after the first few milliseconds following the onset of a visual stimulus which needs to be encoded into - or made a part of - verbal memory.

5) the memory process a system concerned with information processing that consists of its own time constraints for extraction, decay, mode of persistence, susceptibility to interference or erasure.

Please refer to handout on MEMORY PROCESS (#10)

h. 3 Levels of Memory=



*1st Level - being able to match things correctly, eg., you find the word in the story that matches the word printed on the index card.

*2nd Level - being able to remember what something is without helping cues, eg., you are able to point to the word in the story that the teacher asks for

*3rd Level - being able to answer questions that demonstrate an understanding of the material or information presented, eg., you are able to answer the questions at the end of the story without looking back, you can write your own story using the characters developed in the original story, etc.

These concepts will be demonstrated in the following units!

i. Stalking the Mental Image, Stephen M. Kosslyn

1) mental imagery serves as a kind of "mental blackboard" where ideas can be developed and their implications explored

It may be interesting to hear from the class members about their particular brand of mental imagery. This gives clues as to individual styles of sensory and cognitive processing. The students can write about the different forms or manifestations of their mental images followed by a small group exercise where students compare and contrast their mental images. They could also try and duplicate another student's mode of mental imaging.

Related discussion topics include:

1) how is mental imagery related to sensory/cognitive processing, or what does one say about the other?

2) what purpose(s) does mental imagery serve, how does it contribute to or enhance our survival as a species?

3) do you think Stephen Kosslyn's term "mental blackboard" is a good one? What would you use instead of, in addition to, equivalent to?

4) what parts of the brain and the body are involved in mental imaging? Your eyes, visual cortex, memory, etc.

→ Other suggestions: 1) get hold of a mechanical reasoning aptitude test, space relations, geometric forms, i.e., any pen and pencil exercise which will have the students rotating mental images in their head.

2) do some simple math calculations in your head, NO CALCULATORS!, ask students how they do it

3) visual imaging exercise - see Handout #14, Imaging Exercise.

4) guided fantasy journeys - have the students pretend they are a nerve cell and discuss or write about their travels through the body;

an electron in space; a piece of food being digested; a dust particle, etc.

5) activity books designed for car-trips often have pages of geometric images that must be drawn in a mirror image, this can be done in class.

We conclude with our guest speaker, Julie, who happens to be blind. She will talk about how she "sees": what her mental images are like, how she uses her other senses to compensate for no vision, how meaning and understanding of events affect her perceptions, etc.

Our class project for this unit will be the administration and analysis of visual and auditory perceptual measures.

Visual Measures (activities that explore visual function)
1. Ask someone to tell you how to get to a particular destination. Do they draw a map, write down directions, or give you verbal directions? [How we visualize getting to places.]
2. Give someone a lump of clay, and ask them to recreate a favorite object. [Visual memory of an object.]
3. Tape a magazine picture onto a piece of cardboard. Now take another piece of cardboard with a circle cut out in the middle. Place this piece of cardboard over the magazine picture. Ask someone to tell you what they think is going on. [Visual closure-reconstructing a scene with limited visual input.]
4. Present a picture with hidden objects, or words hidden in a word configuration maze. Ask someone to find the hidden objects and/or words. See Handouts #11. [Figure-Ground which is the ability to detect shapes embedded in other visual stimuli or "noise".]
5. Present several mazes and challenge someone to get from one end to another. You may also time people to see how long it takes them to reach the end of the maze, See Handouts #12.

See how well your someone can follow a pencil, ball, or brightly colored object.

Watch someone as they read. Count the number of times they pause (fixate). Ask them to tell you when they are tired of reading, See Handout #13. [Tracking-spatial orientation and eye-hand coordination.]
6. Try this to measure visual point-of-view. Show ten slides each for one second or less. Then add three new slides. What kinds of details are noticed when the slide is in view? when the slide is absent? when new slides are introduced? Or show one scene. Ask for a visual description. Remove the scene from view. Ask people to draw pictorial representations.
7. You may wish to present a variety of forms with increasing perceptual complexity, and ask people to reproduce the forms with the models in front of them. This is similar to Berry's Test of Motor Integration.

Auditory Measures (activities that explore auditory function)
1. Sound reproduction, sound recognition, sound blending - the following activity will measure the ability to hear, reproduce, and recall different sounds.

Stand behind your subject. At one second intervals, you will be saying different sounds and words. Instruct your subject to repeat what you say, and then to write it down.

a. c-a-n
b. d-m-s-p
c. x-b-r-g
d. two-thirty-two
e. l-e-h-k-u
f. sixteen-eighty-one
g. n-t-v-j
h. two-ten-five-nine
i. forty-eight- sixty-five-thirty-three
j. release the brake now

2. Auditory recognition (recognizing new from old auditory input.)
Think up about 60-80 simple words like tree, sock, house, chair, pen, blue, stop, etc. Arrange these words in five lists of twenty words each. Lists one and two will contain 40 different words. Lists three, four, and five, will have repeated words from all five lists. Read a word. Ask your subjects to write, "Yes" if they have heard the word before, and "No" if they have not heard the word before.

3. Auditory memory (retelling a narrative or poetry selection)
a. Play the game where at least ten players are seated in a circle. The first player says he is going to the supermarket to buy ----- . The next player must first state what the last player is going to buy, and then what he will buy. The game continues with each successive player having to repeat in order all the items that have already been named before adding his own. Try this with a dinner party inviting movie and television celebrities.
b. "Concentration"—A popular child's game where at least five players are seated in a circle. The more players, the more challenging. Players hit their knees once, clap their hands once, and snap right/snap left saying, "Concentration . Are you ready? If so, let's go. Category: Colors (or Names, Flowers, Cars, etc.)." Each player must name a different category item. Whoever repeats an item already mentioned is out of the game.

4. Auditory Organization
Come up with twenty word-pairs (eg. square-glass, top-washer, heart-arm, paper-chair, clip-kitchen, etc.). Read the entire list out loud. Then read the first word only and see who can remember its paired associate.

5. Imaging to Auditory Input
a. Play a musical selection and have students draw a design or write a poem.
b. Verbally describe a picture not in view, and have students draw the picture according to your spoken directions.
c. Have students draw a map according to spoken directions.
d. Do a narrative or poetry reading and let students draw pictures while you read.

c. have students draw a map according to spoken directions

d. draw pictures while hearing a poetry or narrative reading

Gather classroom and outside data. Compare and contrast, analyze data results. Be sure to exhibit data collections and artifacts somewhere in the classroom. This is another area which could be expanded into an individual or group project for BRAIN-DRAIN.

Other Homework Suggestions and Activities (in addition to current events, vocabulary tree, projects for Brain-Drain).

1. define what perception is -- to you.
2. relate to someone five things you learned about visual and auditory processing or perception.
3. write a guided fantasy journey about a visual or auditory piece of input, what does it see or hear (or feel, smell, taste), put it into a play or dialogue form.
4. consult the Guiness Book of World Records for record-breaking perceptual events.
5. select five quotes form a quote collection source, newspaper, magazines, etc., that describe the essence of perception for you, come up with your own.
6. with some friends devise a Trivial Pursuits, Jeopardy, Password game about perception.
7. explain how you would teach this unit.
8. report on persons with extra sensory perception, what do you think.
9. help set up a resource or learning center on perception to the class.
10. interview persons that are visually or auditorially impaired and find out how they see and hear.

This is the last academic unit preceding field trips and science fair. it involves two components: language and learning how to read.

Unit 6 - "Use It or Lose It"

Unit 7 - What Goes Into Reading?

Let us work our way into this unit by discussing auditory perception and how it relates to language acquisition. Present a brief sketch of the physiology and anatomy of audition; go through the different parts of the ear in addition to sound waves, pitch, timbre, etc. The accompanying Handout #15 is recommended. A filmstrip would be fun, and a change of pace.

Today we have a guest speaker who is a research scientist at Weyerhaeuser Corporation. Warren is a specialist in vibration analysis, and will demonstrate a number of audition principles to the class.

Following this is a review of the auditory measures and a discussion about data collection and results. With each auditory measure, make a connection between that auditory decoding process and how it relates to language learning. Sound reproduction, recognition, and blending are important for learning language by imitation. The child is learning the most discrete units of language which are sound through "mimicry", correct discrimination of sounds, and building into more complex units of sounds which are words. Words are the basic units in expressive language. Words are grouped together to form sentences which convey mental thoughts in spoken or written language (reading). Auditory recognition, memory, and sequencing are tied to higher-order linguistic functions such as being able to follow directions, navigate your way to new places, ability to recall auditory input, remembering what comes when and where, etc. Imaging to auditory input takes place in the right half of the brain, and works on building up our repertoire of creative skills and problem-solving. It taps the ability to understand spoken

language, and to individually interpret this input into another sensory form. Language is the link between hearing something, interpreting it, and recreating the input.

By way of review:

5 Senses relay information → Perceptions (Visual, Auditory, etc.) → Auditory inputs are important for language acquisition → Memory is important for language acquistion [3 Levels = recognition, recall, recreate] → a necessary precursor to learning language is IMAGING (or thinking to oneself in terms of language) → language acquisition precedes learning how to READ= a form of learning → intelligence (capacity to learn) ← as a result of learning and sensory experiences
→ creativity (ability to self-ransend)

We are leading into an exercise which will teach us about the acquisition of reading, or will take us back to first grade where we learned how to read our native language, English. We will continue our discussion of language acquisition because being able to speak the language is necessary before being able to learn how to read. What you will find is that reading just kind of happens, it all "clicks," and that we don't learn how to read so much as letting nature take its course. More on this later.

Why does anyone bother to learn language? Well, it starts with PERCEPTION (selecting out distinctive features from sensory input to the brain) + MEMORY (distinctive features are stored categorically here, and can be recalled as needed) + a need or desire or drive to COMMUNICATE results in language-learning. Tonight, at home, observe an infant (sibling, relative, friend, neighbor) as they communicate with you, and you with them. Write down what you observe to answer questions of how do infants communicate without language, and what does beginning or early language acquisition look like?

Today's theme is "Use It or Lose It." You may have heard that you can learn many languages fluently from ages 0-5, and you speak without any kind of an accent. Let's look at Handout #16 [illegible], taken from Joseph Chilton Pearce's Magical Child. This is about his four year-old son who demonstrated remarkable musical ability. It appears that we have different learning capacities and stages in our lifetime, some of shich we may lose and some of which we continue to build on throughout a lifetime. It becomes more difficult to learn a foreign language from ages 6 or 7 onwards; but we become increasingly proficient in the use of our first-acquired language (or languages in the case of bilingual parents).

The next activity involves some creative brain-storming about what is a "language organ."

Have the class write down their reactions to a "language organ." Is it alive? man or fowl? Does it taste like liver, etc.? Collect the reactions, and share with the class as appropriate.

This leads into Omni 84's article on "Noam Chomsky: An Interview." Noam Chomsky is a psycholinguist. He emphasizes the role of the mind outlining the unconscious mechanisms that make human speech possible and insisting that a genetically programmed "language organ" in the brain primes the human infant to master his mother tongue. That is, Chomsky is saying that the brain structure plays an important role in shaping language. He also postulates that language development should be called, or looked upon as language growth because the language organ grows like any other body organ. The different linguistic experiences -- such as English vs. Japanese vs. Russian etc. -- modify the language organ's structure. Chomsky also talks about a universal grammar. This is the sum total of all the immutable principles that heredity builds into the language organ. .....We're designed by nature for English, Chinese, and every other possible human language, but we're not designed to learn perfectly usable languages that violat

universal grammar. These languages would simply not be within our range of abilities...."

What the language organ implies is that the brain is structurally organized (i.e. placement of neural cells) to acquire language just as the brain is also made or designed to receive and process sensory input which results in learning. The idea of a universal grammar or innate program for language organization also implies that language is structurally organized in the brain according to a genetic blueprint received at birth. We as earthlings couldn't acquire Martian language because our sensory processing modes would be unable to receive and interpret the Martian linguistic input.

Thus, the language organ refers to the areas in the brain involved with language growth and development. The universal grammar contained in the brain tells of all the linguistic experiences possible for acquiring a human language. Our specific language experiences modifies the language organ so that the language organ develops to acquire a specific language such as English or Chinese.

Remember, the motive for language acquisition is a NEED to communicate. This, in turn, facilitates learning.

And now, on to a sampling of foreign languages.....

This part of the lesson will start out with an exercise in deciphering and wordness. Sample handouts are included (Handouts #17, # 18, #19), but be encouraged to collect and design your own.

The first handout should contain a passage that is indecipherable to a native English-speaking classroom. The one included is in Hebrew; however, languages such as Chinese, Russian, Arabic, or Korean would also do nicely. Ask the students if they can understand any part of the text at all. Why

or why not? Introduce the concept of "wordness" as being a key ingredient to deciphering spoken and written language.

The next handout is a Polish text. Again, languages such as German, Portuguese, Check, Danish, or Hawaiian would suffice. Ask the students if they can hazard some guesses as to what the text is about. Ask them to describe their reasoning processes outloud, i.e., deciphering attack strategies. Point out the presence of wordness and how it relates deciphering.

The last handout contains a nonsense language paragraph with comprehension quetions following. Make up your own collection, it's fun!

Example: The smootz bilked just as the iddy theezled down the outchpas. The outchpas had no reebox, and thus could not theezle the iddy. Fortunately the outchpas knew how to bilk, and this made the smootz very happy.

1. Who theezled down the outchpas?
2. How come the outchpas couldn't theezle the iddy?
3. What made the smootz very happy?
4. Draw illustrations for: a smootz bilking, the outchpas' reebox, a happy smootz, an iddy theezling down an outchpas.

Have the class complete the exercise. As follow-up activities just prior to class discussion of what these exercises all entailed, ask the students to:
1) design their own nonsense stories and questions AND/OR
2) in small groups of 3 or 4, devise a secret language or code, then write a story or dialogue or poem to be shared with the class:

Now have the students react to, and discuss, what was involved in deciphering an unknown or unfamiliar language. Some points to be included:

1. visual and auditory perception or seeing and hearing language
2. a desire to communicate and understand sensory input
3. symbols are linked with meaning

4. symbols are recognized by matching old stored inputs with new inputs
5. symbols are stored in memory as a result of recognition, having a meaning and being rehearsed
6. use of past experience to construct meaning when not enough information is available or to generate new meaning
7. above experinces and activities constitute learning whose key components are intelligence and creativity, and result in a new creation such as a story or poem or dialogue

Communication involves all facets of our sensory being and processing equipment. It is more than just talking or listening. Suggested learning activities: charades, improvisations, mimes AND/OR We are on a class trip to China. How could we, or would we, strategize to find out which bus to take to our hotel, get directions to a museum, order dinner in a restaurant, buy a postage stamp, find out what time the zoo closes, etc.?

We have now returned from our class trip to China. Our next adventure in language is to see a 10-15 minute short film all in French, and then try to decipher it. How do we do it? The use of contextual cues + our past experience + making predi-tions about the outcome, and constructing hypotheses based on the probability that an event did occur or failed to occur.

Time for a quick break and diversion. We have seen the importance of being able to identify "wordness" to enact decoding strategies with unfamiliar material. Let's do the following exercise. The teacher will pass out a page with 5-10 lines of 5 similar words each. Example:

1.	spoke	speaking	spotted	slovenly	spacey	
2.	book	boyish	beauty	bullit	bloated	
3.	lovely	lakeside	lumpy	liltingly	locksmith	ETC.

The students should have another sheet to cover up the page. The teacher flashes a word from Line 1 on an overhead projector for a second, and students circle the word they saw. Continue on with the other lines having students reveal successive lines to themselves after the word is flashed before them.

This word recognition exercise demonstrates that it is 100% accurate with a single second viewing rate. Matching a recent iconic image is very strong. This task becomes more difficult, and less accurate, with time delays between viewing and matching and with more complex stimuli that requires more encoding.

Now pass out a difficult text in pose or poetry (Shakespeare, the Bible, Wall Street Journal, Locke, Einstein's Theory of Relativity, etc.), and have students take turns reading aloud. Discuss their feelings and reactions to reading material that makes no sense to them. Does it encourage independent reading, or cultivate an enjoyment for reading?

Everyone take a breather, you've earned it! Break is over, and thinking caps are replaced....What Goes Into Reading? List class answers on the board.

Some ideas:

recognize symbols attach meaning	tracking
discriminate one symbol from another	pay attention
sequence symbols	desire to read
distinguish visual and auditory features of symbols and sounds	sustain input
process visual information	iconic image → STM → LTM
have language	share what you remember
	bring in past experiences

Out come our reading texts, "Qu 'est-ce qu 'on dit, mon petit?" (What do you say my dear?)*. You have got to be kidding. No, quite seriously, let's experience learning how to read. Pronunciation doesn't matter. Concentrate on

*by Sesyle Joslin, published by Young Scott Books, N.Y., 1966.

being able to match words, connect a meaning, use words as meaninful symbols kind of like our nonsense language and secret codes. Let's break the code.

Ask for a simple sentence. I have a book. On a poster board, I write, I have a book. / J' ai un livre. } Students are asked to use whatever memory Strategy will help them associate the word configuration "livre" with the meaning of book. They can draw a picture, mentally image, get a specific smell or taste sensation, use a color association, pneumonic device etc. Ask them to record memory or associational tactic on 3 x 5 cards on their desks, or at their disposal.

Let's continue and make up a simple story. I pick out vocabulary words in each sentence. Students record how they will remember the French word and the English meaning. Tell students to save all their cards. You may wish to discover how different students decide how to remember something, and share this with the class.

The students have had a chance to experience a foreign language. Time to intorduce Heidi, a polylinguist (German, French, Spanish, English), who will talk about how she experienced learning several languages, how she keeps them straight, problems or eccentricities, any confusion, how she experiences communicating in each separate language and overall, etc. Go, Heidi, go!

The class has experienced translating spoken language (English sentences rewritten in French) into a written form, and doing interim meaning, association things that will help them to remember what the French word means. They have their 3 x 5 index cards on file with their pictures or other memory-meaning association tactic.

Let's practice a bit. I write a French vocabulary word from our class made-up story on the board, and ask the students to hold up the card with the memory-meaing association tactic (usually a picture). We repeat this exercise with remaining vocabulary words. Then, I hold up a picture AND students must respond outloud while simultaneously writing word on a 3 x 5 card. This is repeated. Now, alternate with French word stimulus picture response AND picture stimulus French word response.

Now, focus attention on either a book of simple stories, or a simple story handout. Time for the first step of memory or word-recognition. Have students go through the story and circle vocabulary word #1, then #2 in a different color or underlined, #3 in boxes or another color, etc. The next task is memory step #2 or word-recall. Have students match their pictures to the printed words and say the meaning outlined (softly to themselves). The last step in memory is to recreate, or to apply the meaning of words in understanding the written story...i.e., reading.

We will continue with the meaning approach, and will try to deduce as much of the storyline from non-reading strategies, or use of context and general knowledge dereived from our experience repetoire. Look at the sequence of pictures. What are they saying or implying about the story action? Can we deduce a general meaning or idea of what the story is about? The teacher then asks "shaping questions" which engage the students in predicting outcomes.

Now, have the class read the first paragraph (or more) in French silently. Tell them to sound out words phonetically. Remember, pronunciation doesn't matter; trying to link a word with a meaning, or deriving a general understanding of the printed material is. Have them use their word matching and picture meaning tools (3 x 5 cards) to help them translate the words, and let them construct the

general meaning based upon what we have established in class discussion as possible/probable story action and their individual understanding of the printed text as they read it. Continue until the story's action has been unlocked.

Try to stress the elements that are part of reading acquisition: wordness, word recognition, language, imagery, meaning, memory. Also, that reading is a "language thing."

The teacher can stop here, or build upon this exercise. That is, students can continue to translate French stories into English meaning. They may wish to do partial translations of English stories into French including text pictures to aid in cracking the meaning mystery. Students can write their own story sequels using French and English, or write their own French/English stories on their own. If more difficult stories are introduced, the approach remains the same. Familiar words are sighted first and quickly reviewed for meaning. The new words are selected out and meaning pictures are made. The students practice word recognition and meaning matching with new words. They attempt to deduce the general meaning of the story prior to reading. They then read the story to confirm or deny their initial hypothesis. As students build their vocabulary and reading fluency, there will be less reliance on the 3 x 5 index card method which represent initial reading acquisition strategies.

Students should have an appreciation of what goes into reading acquisition after this. They should have alternative strategies to the approach of tackling very difficult printed materials and/or a foreign language.

No homework assignments tonight. Tomorrow is a field trip day, and the next day is our final day in this unit culminating in....

BRAIN DRAIN

Today is Day #7, or Unit #7. Field Research Day. In other words, let's go do it! In the morning, school buses will transport students from school to the Pacific Science Center. They will participate in the demonstrations and view the exhibits, and will be asked later on to tell or write about an exhibit that impressed them or imparted new learning to them. It just so happens that the major feature as P.S.C. is an entire exhibit on "Creativity" including a large computer display.

The students will have an opportunity to integrate the material that has been presented to them as they view real-life applications of the concepts and activities that have been taking place in the classroom. This activity will serve an enrichment function in having the students interact with a diversity of sophisticated materials that surpass what is possible within the confines of a classroom. It exposes the students to centers of learning exploration and adventuring in their community. Each student is afforded a personalized learning experience as they proceed through the exhibits at their own pace. Field trips are always exciting and stand out as a signigicant event in our memories of school.

After a picnic lunch at Seattle Center, the students are transported to the Federal Way Convalescent Home located on south 310th Street and 14th Avenue South. The students have been broken into teams. They have already prepared a list of interview questions, and decided how they will operate as an interviewing team. They will be encouraged to do adquate preparation so as to reduce anxiety, but to also "play things by ear" and allow the interviews to spontaneously transpire. That evening, student teams will prepare a "scholarly journal" article based upon their field research. The articles will then be "reprinted with permission" and compiled in ur class' Journal of Learning. One student

team is assigned to interview a retirement home resident. Interviewing and recording tasks are split up, alternated, etc., as appropriate to particular team functioning.

The activity accomplishes several functions simultaneously: the students will act as participant observer researchers, chance to apply classroom knowledge to "real life," the retirement home residents and students enact a reciprocal learning situation as they exchange world views and perceptual filters.

After our visit here, the bus takes us all back to school where students are picked up by their parents.

Day #8 or Unit #8 - Brain Drain Fair AND Pizza Party. This activity will be the highlight of all of our coursework, and is the classroom's longer-termed goal to organize and plan for. It teaches the student about short vs. long-termed goals, and how to structure activities to achieve goals. The student will have a wider field in which to interact with the conceptual material presented, and to formulate concrete applications in individual and small group projects. The fair will provide a forum whereby the students can display their work, receive feedback, derive a sense of accomplishment, and take pride in their work. The fair will also involve people from the community which will hopefully help to establish future paths of communication and a cooperative school-community working relationship.

Today we turn the classroom into a physical and colorful manifestation of our course, "Mind Adventuring." The students know their final projects are due today as well as their course/instructor/self evaluations. It is hoped that a core of parent volunteers will be on hand to help with setting up the fair in addition to any community persons such as local business and professional representatives who wish to participate. Important to note is that student

exhibitors, parent volunteers , teachers/teacher-aides, and community persons will be subject to the student executive committee responsible for planning and coordinating the fair.

On display will be the students' journals organized around the theme of personalized mind-adventuring, individualized learning profiles, and our class' literary magazine, "Reflections." The specific exhibits, demonstrations, learning centers will represent the students' small group projects. Possibilities include a bulletin board that illustrates the course theme of learning and the mind, a mural about creativity and intelligence, a videotape about language and reading acquisition, a photography exhibit, learning "fun" centers which demonstrate perceptual measures/optical illusions/relaxation techniques/ Ann Pick's distinctive features experiment, etc., kinesthetic learning such as dancing out the multiplication tables or reinacting Einstein's theory of relativity, learning "how to _____." There will be an in-class library that will house individual students' research and report projects.

Let this be a climax for the class. Ride the waves of excitement and intensity. Let the entire day simply happen. Don't forget the pizza party.

ENJOY!

List of Handouts

1. Handout # 1 - Jean Piaget's Stages of Learning
2. Handout # 2 - Four Areas of Learning
3. Handout # 3 - Brain Structure
4. Handout # 4 - Lesson on the Brain
5. Handout # 5 - Fantasy
6. Handout # 6 - Mind Map
7. Handout # 7 - Classroom Inquiry Problem
8. Handout # 8 - Group Consensus Problem
9. Handout # 9 - Ann Pick's Experiment
10. Handout #10 - Memory Process
11. Handouts #11 - Figure Ground
12. Handouts #12 - Mazes
13. Handout #13 - Tracking
14. Handout #14 - Exploration of the Tactile Sense/Imaging Exercise
15. Handout #15 - Summing It Up
16. Handout #16 - Use It or Lose It
17. Handout #17 - Hebrew Text
18. Handout #18 - French Text
19. Handout #19 - Nonsense Language

Handout #1

JEAN PIAGET'S STAGES OF LEARNING

STAGE ONE: SENSORIMOTOR PERIOD: Birth to two years

Reflex period, child learns from environment and responds to outside stimulus; by two, child entering period of symbolic representation.

STAGE TWO: PREOPERATIONAL PERIOD: two to seven years

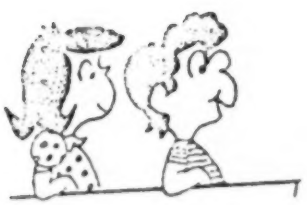
Child operating at the level of symbolic representation as seen by imitation and memory; egocentric - sees world as it appears to him, has difficulty seeing world through the eyes of others; end of this period sees the child beginning to think prelogically.

STAGE THREE: PERIOD OF CONCRETE OPERATIONS: seven to twelve years

Child can think logically about things he has experienced. Child can now think forward and backward in time (reversibility); therefore, child can now see the relationship between adding and subtracting; beginning of abstract thinking.

STAGE FOUR: PERIOD OF FORMAL OPERATIONS: twelve to adulthood

Child begins to reason logically about abstract things that he has never experienced; child becomes capable of deductive and inductive reasoning.



Pulaski, Mary Ann, Understanding Piaget, New York, Harper & Row, 1980.

Handout #2

Four Areas of Learning

I. Four areas of learning are: COGNITIVE
AFFECTIVE
INTUITIVE
SOCIETAL

II. Definitions

1. Cognitive = thought processes ⟶

knowledge	analysis
comprehension	synthesis
application	evaluation

2. Affective - feelings and emotions

3. Intuitive = instinct.

4. Societal = people and community

III. Learning Styles

1. visual
2. auditory
3. olafactory
4. tactile
5. taste
6. kinesthetic

What kind of a learner are your?

We will use these concepts to describe our thought activities.

Handout #3 - Brain Structure

From Magical Child, Joseph Chilton Pearce, E.P. Dutton, N.Y., 1977

respond and answer (though the suspicion occasionally arose that someone sneaked that receiver off and listened in).

Among neuron telephones, a stricter propriety is maintained because a single cell may have as many as 10,000 of these direct lines branching out from it, each line in turn branching, linking that cell to anywhere from 30,000 to 600,000 other cells, each with the same paraphernalia. The number of possibilities for relaying sensory information back and forth is infinite; no number system could encompass the possibilities (particularly when we add those 20 million molecules, each capable of producing some 100,000 proteins, within each cell).

I need a model of concept structuring to clarify the way in which the infant-child structures a knowledge of the world and to show how this structure then becomes the primary process of the brain, on which all creative learning and interaction will thereafter be built.[1] Think of the brain as a large newspaper office, divided into five departments. The biggest and most important is the visual department, followed by hearing, feeling, smelling, tasting. Each department is broken down into many separate offices, each with its specific area of expertise in that particular sense medium. Each office is jammed with files and a huge array of telephone lines connecting it to other offices. Each department has specialized sensory reporters that send in messages about events out in the world. The visual reporters send messages about how the event looks; the smell reporters, about how it smells; and so on. The reporters are connected to their respective departments by long-distance telephone lines that disperse through an astonishingly streamlined office called the reticular formation. The lines between the offices pass through a secretary who screens the rhythmic character of the message to see if it is appropriate, relays the message if it is, and then informs the sender cell that the message was appropriate, which the cell relaying the message dutifully records in its files. The next time a similar message comes in, that cell will know that that particular line, among its thousands, has an appropriate rhythmic pattern for that kind of message unit.

Although each office has its specialty, just as a sports editor or an advertising editor does, each office also builds up a file system pretty much covering the activities of all the other offices through the continual cross-indexing of message relays. If really needed, any office could pinch-hit for any other. Furthermore, through the indexing and overall relay system, each office takes part in nearly all activities in one way or another. The job of the news office as a whole is to come up with an accurate composite report on the world event by putting together the various reports as they are processed by each department.

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From Magical Child, Joseph Chilton Pearce, E.P. Dutton, N.Y. 1977

Follow a message unit coming in from a visual reporter. Hundreds of thousands of these units, or data bits, are firing in every second, but there are hundreds of millions of cells available for processing them. The message unit comes in through the central receiving office and is relayed to its appropriate department. The unit rings in its rhythmic pattern on many millions of lines ad lib, and several millions of those offices find that particular pattern appropriate to their own specialty. Office A's secretary relays the information in, meanwhile informing his/her incoming line that the message is appropriate. On receiving the information unit, the office relays the similar aspects of the message to all those offices that its files show handle similar information. The office also relays out to offices on file known to handle those particular bits of the message unit inappropriate or dissimilar to that office's specialty or precedent pattern. Finally, the office relays out on its own all-points call (ringing every line it has) that information in the message unit for which it can find no trace of precedent, no point of similarity and for which it has no record of an office that does handle such a point of information.

Office A then receives confirmations on the various appropriate targets receiving messages. Eventually, it gets back information on the more remote rundowns on offices handling the unknown, dissimilar parts of the message (those that had to be relayed out to all points). This information feeding back then gives that office a wider range of immediate relays for points of similarity and dissimilarity next time. Its own capacities have been expanded; it can take part in wider patterning of information.

When dissimilar information is rung out over the far-flung telephone network, some offices may have only a few points of similarity to that information, but these are enough to be accepted by the secretary. That office must then rerelay the remaining points of dissimilarity out on another all-points call, and this must continue until all points of information have been accounted for. This may require (in the early days) establishing new lines and using established lines in new ways.

The dissimilar items prove far more stimulating to the activities and expansion of the offices than the routine messages, but no message can be accepted and relayed unless there is some initial office with at least some points of similarity to that message. That is to say, no new experience can be accepted and interpreted unless it has at least some similarity to past experience.

Office A is continually receiving new reports directly from the sensory reporters, continually receiving confirmation and destination points of its outgoing messages to other offices, and continually receiving rings from other offices asking for similarity checks against the precedent patterns of

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its particlar part of the action. Office A may very well eventually get relayed back to it parts of its own messages sent out to others.

In all this welter of rhythmic activity, a pattern is worked out for some particular visual event. The pattern is the route the messages follow in being worked out into a composite interpretation by the cross-indexing of all the offices involved. These patterns between the offices get smoother and faster the more they are repeated, which means the more that experience is repeated. The secretaries develop the ability to recognize the message units handled before and do not have to check back with the office for file confirmation. Finally, confirmation of having accepted the message no longer needs to be reaffirmed. Thus, practice is the way the learning becomes engrained.

Some points of similarity are necessary in order to have some office find some appropriateness and so be able to accept the message, get it past that secretary, and get the work going on the dissimilarities. On the other hand, the department grows and becomes more sophisticated and expert in combining its overall knowledge through the influx of new information.

The department's final composite can never be found in any single office. The composite is the action of all the communications between all the offices. The composite is an instant patterning of this overall action, and the overall action becomes, through repetition, a concept or accepted editorial policy of that department. New, strange, or unprecedented reports coming in will be checked against the growing number of these patterns of precedent (concepts), which become the norm or standard of interpretation. The richer the scope of the editorial policy (the more concepts), the more complex or unprecedented reports that department can handle.

Points of dissimilarity that find only the most remote traces of similarity may require relaying back and forth many times, each relay including the particular acceptances found and the routes the information followed. This homework may run on far into the night, long after the sensory reporters have gone home to bed and the intake lines are quiet. This activity is part of a *regulatory feedback* process that goes on in the entire establishment almost all the time. Later on, in Chapters 9 and 10, we will see how this regulatory feedback works with larger and larger units of meaning, finally relaying whole concepts and groups of concepts back and forth, creating larger categories of concepts.

Finally, we come to the synthesizing, or cross-relating between departments themselves, which must be done to make an overall picture of the event. Essentially the same activity takes place, but between smelling, hearing, seeing, and so on. The department of hearing relays its composite units

of information to the departments of smell, taste, sight, and feeling and receives their incoming messages in turn. Similarity-dissimilarity dispersal follows the same pattern; the references are then between the senses, and Office A, over in the sight department, will receive a cross-indexed similar-dissimilar feedback report from all the other senses and eventually know the composite of all the senses in relation to its own fixed pattern, its piece of the action.

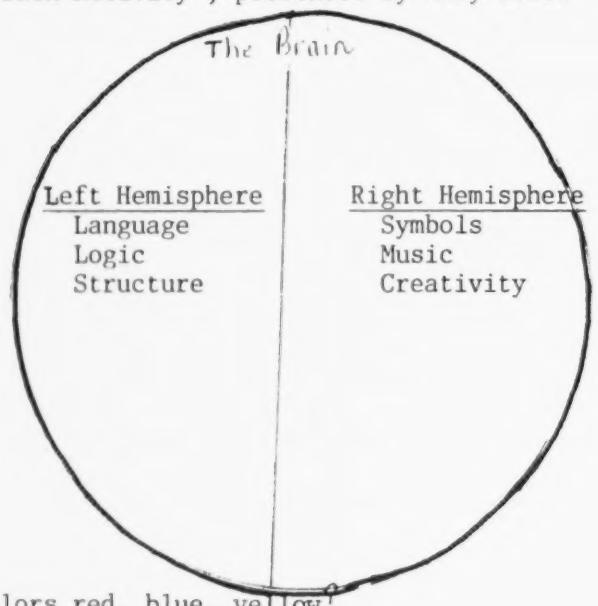
All this takes place in milliseconds, and it takes place continually as long as consciousness is maintained. The feedback over new information may run on into the night long after consciousness has shut down. Through the continual feedback system, one office's activity might participate in virtually every conceptual activity of that particular department or even the whole plant (the entire brain). That is, no thinking cell holds a single memory item, as we used to believe. The cell is simply a possibility to be enacted by electrochemical connections with other cells in certain rhythmic relay patterns. Any cell's significance changes according to the relay pattern in which it plays a part. Office A functions rather like the typewriter key giving me letter *a*. Letter *a* can mean all sorts of different things and even sound different ways, depending on the pattern of action into which I incorporate it. In order for a neuron to think, it acts in pattern with other groups of cells, and the possibilities for such patterning are infinite.

Some of these patterns for action (concepts) are given at birth. Certain cells are preprogrammed, already wired to certain relay patterns with other cells. All it takes is a certain kind of stimulus, from a certain sensory reporter to activate this pattern. The newly hatched baby chick recognizes seeds (having a sufficient number of points of similarity to that prewired pattern) appropriate for its food. No learning is necessary, but it is still a concept in the sense that a patterning of incoming information is involved (in this case, a pattern that simultaneously acts as a coordinate of muscular responses in the body).

The newborn human has such a genetic concept for sucking when a nipple is placed in its mouth. The sensory information appropriate to this pattern is a tactile stimulus of the lips. The brain has this built-in pattern ready and waiting for just this information. The processing of these data is automatically the coordinating of a proper muscular response. We might not think of this as an intellectual act, but it so completely absorbs the baby's mind-brain system that s/he cannot attend to anything else while in this act. One concept at a time is the rule in the early days because the activation and coordinates needed are too new to allow for any division of labor.

Lesson on the Brain

(Excerpted from a workshop, "Mind-Brain Activity", presented by Mary Ellen Floyd in May of 1985).



Our Five Senses are:

1. Eyes (Visual)
2. Ears (Auditory)
3. Nose (Olafactory)
4. Mouth (Taste)
5. Touch (Tactile)

Hologram Theory of the Brain

The whole is contained in each of the parts. The part is able to generate the whole.

I. Cross-Sensing

1. What do you "see" in the colors red, blue, yellow?
2. What do you "hear" in the colors purple and orange?
3. What do you "feel" in the colors, brown, white, black?

II. Free-Association Exercises

1. Brainstorming: let your thoughts wander on a given theme. Record your thoughts on paper in stacatto-like phrases.
2. Listen to the music being played. Write down what it makes you think about. Write down the actions it makes you feel like doing.
3. Write down the first word that comes to your mind when I say a stimulus symbol.

Handout #5 - Fantasy

YOU ARE INVITED to experiment with BLOOM on a subject close to your heart. On the following lines write one "imperative" statement for each level of Bloom. I refer to imperative statement rather than question because I have found it most helpful to use a process verb for the first word in each sentence. This helps us get away from who, what, when, where and why - and this move to the process verb allows us to see at what "level" we are functioning.

Write your adventure in response to this question, "What single undertaking would you choose if you had one million tax-free dollars?"

FANTASY_____

I._____

II._____

III._____

IV._____

V._____

VI._____

Think of these statements as the itinerary for your adventure.

Good Luck and Think Big!!!!!!!

From "Practical Curriculum Strategies for Gifted & High Achieving Students," Susan Kovalik, Bureau of Education & Research, Paso Robles, California, 1982.

Handout #6

THE MIND MAP

(an easy effective way to take notes)

PUT THE MAIN IDEA IN **THE CENTER** OF **THE CIRCLE**.
ATTACH LINES FOR **SUPPORTING** IDEAS.
ALWAYS USE CAPITAL **LETTERS**.
ATTACH ADDITIONAL LINES WHEN NEEDED.
USE COLOR TO IDENTIFY AN ENTIRE GROUP OF IDEAS.
SMILE, IT'S FUN!

From Practical Curriculum Strategies for Gifted & High Achieving Students, Susan Rowlette, Bureau of Educational Research, Paso Robles, California 1992

Handout #7 - Classroom Inquiry Problem

Figure 6.5. A Classroom Inquiry Problem.

Problem Setting: Pretend the year is 2172 and you and your spaceship crew were on a 100-year outer space mission. You have all just awakened from your solar sleep three weeks prior to your reentry into the Earth's atmosphere and scheduled touchdown. You discover that your radio works, but you can't communicate with NASA. The lines are dead. You are worried about why NASA doesn't answer, but also you are worried about coordinating landing plans and instruments. Your spaceship has a manual on landing without NASA's help, but it has never been done that you know of. To complicate matters, two days before reentry you hit a terrific solar storm. Many of your instruments malfunction. Bravely, you and your crew prepare to land on Earth.

Miraculously, the landing was perfect. The crew is safe and alive. However, when you open the door of the spaceship, you realize you are not at the NASA landing strip in Nevada.

All your instruments that tell latitude and longitude, etc., broke during the storm. You must discover—

Focus Setting: "Where on Earth you are!"

Structuring: You instruct your crew to make a list of the things they see around them to help decide where they have landed. They agree to meet back at the ship in an hour to compare data.

I am going to tell you what was on the list briefly—it is your job to ask me more specific questions about the items listed so that later you can give opinions about where they are, from the information I have given and you have asked about.

The List:

1. landed on flat ground
2. miles in the distance emerald green looking mountains
3. a small river running (20 feet wide) one-half mile from space ship
4. several large hawks circling above area from time to time
5. temperature about 85 degrees—sunny
6. a clump of trees near ship that look stunted but have leaves on them; another group of trees that look like they were planted with their roots in the air instead of having leaves on their tops
7. the soil is rocky, but there is lots of scrubby green plant life
8. snakes sighted
9. down by the river dog-like paw marks
10. a group of small ape-like creatures seen in rocky hills 1½ miles from spaceship—probably baboons.
11. biggest find of all—houses sighted; constructed of materials found in area
12. people seen high up in hills through binoculars tending sheep

From Growing Up Gifted, Barbara Clark, 1981. 47

Accepting, Clarifying:	By asking more questions about the list I've read, you should be able to give an idea as to what: 1. country they landed in 2. time of year it is 3. time of day 4. type of life the inhabitants are living
Inquiry Session	
Process Debriefing	

Figure 6.5 is the format of the original inquiry session. Many modifications have been devised, and the strategy has been used for problem-solving in science, social science, class discipline, and other subjects. Students can also be given opportunities to work on separate inquiry skills, such as asking good questions and finding irrelevant data, in short skill development sessions. Through inquiry, students can become aware that truth still remains to be discovered.

Evaluation: through the debriefing period, the students may be helped to see their processes as less or more powerful and to find ways of improving their skills.

Other dissonant events:

—a glass filled with water and a glass filled with alcohol look the same. Put an ice cube in each and different things happen. In this case only show the demonstration. Do not volunteer information on the contents of the glasses.

—see the resource book with the *Inquiry Development Program* (1966).

3. Decision-Making, Alternative Thinking

Rationale: gifted students will function in society as change agents, innovators, and reconstructionists. We believe that our societal problem-solvers will come from this group. By being exposed to many ways of viewing problems, students may find better solutions. Give students experiences that allow them:

—to become aware of bias in thinking, the difference between belief and fact.

—to see that each conflicting viewpoint may be valid.

—to see the importance of sources of information.

—to experience the importance of cooperation and consensus in group action.

—to seek many alternatives before deciding on solutions.

If we want to help our students make decisions on their own, we must present them with only the alternatives for which they can understand the consequences. If they cannot, they are not really making a choice. We must begin there and then gradually increase the number and complexity of the alternatives. In this way, our students will gain confidence in their abilities and become better decision-makers (Jellison & Harvey, 1976).

Decision by Consensus

Time involved: approximately one hour.

Material needed: instructions (Figure 6.6), group summary and scoring sheets for each student (Figure 6.7).

Organizational pattern: groups of 5-7, flexible grouping, responsive environment.

Teaching function: modeling, encouraging student decision-making in educational matters, facilitation of group exercises.

Procedure: this is an exercise in group decision-making. Your group is to employ the method of *group consensus* in reaching its decision. This means that the prediction for each of the 15 survival items *must* be agreed upon by each group member before it becomes a part of the group decision. Consensus is difficult to reach. Therefore, not every ranking will meet with everyone's *complete* approval. Try, as a group to make each ranking one with which all

Handout # 8- Group Consenses Problem.

Figure 6.6. A Group Consensus Problem.

Instructions: You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200 mile trip. Below are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance for your crew in allowing them to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on through number 15, the least important.

Box of matches	_____
Food concentrate	_____
50 ft. of nylon rope	_____
Parachute silk	_____
Portable heating unit	_____
Two .45 calibre pistols	_____
One case dehydrated pet milk	_____
Two 100 lb. tanks of oxygen	_____
Stellar map (of moon's constellation)	_____
Life raft	_____
Magnetic compass	_____
Signal flares	_____
First aid kit containing injection needles	_____
Solar-powered FM receiver-transmitter	_____
Five gallons of water	_____

From Growing Up Gifted, Barbara Clark, Merrill Publishing Company, 1981

group members can at least partially agree. Here are some guides to use in reaching consensus:

1. Avoid arguing for your own individual judgments. Approach the task on the basis of logic.
2. Avoid changing your mind only in order to reach agreement and avoid conflict. Support only solutions with which you are able to agree somewhat, at least.
3. Avoid "conflict-reducing" techniques such as majority vote, averaging, or trading in reaching decisions.
4. View differences of opinion as helpful rather than as a hindrance in decision-making.

On the Group Summary Sheet (Figure 6.7), place the individual ranking made earlier by each group member. Take as much time as you need in reaching your group decision.

Scoring instruction for decision by consensus: the prediction is that the group product will be more accurate than the average for the individuals. The lower the score, the more accurate. A score of "0" is a perfect score.

Individual score: Each individual can score his own sheet. As you read aloud to the group the correct rank for each item they simply take the difference between their rank and the correct rank on that item and write it down. Do this for each item and add up these differences—*disregard "+" and "-".*

To get the average for all individuals, divide the sum of the individual scores by the number of individuals in the group. Compute the group score in the same way you computed each of the individual scores. If our hypothesis is correct, the group score will be lower than the average for all individuals.

Possible questions for the group:

1. Did the group really go by consensus? Or did we gloss over conflicts?
2. Did the group stay on the intellectual or task aspects or did we stop to examine our process to see how we could work more effectively?
3. How satisfied were we with the way the group worked? How efficient were we?

   1 ——— 9
   very poor — excellent
4. How satisfied are you (as members) with the group?
5. How much influence did you feel you had as an individual on the group decision?
6. Did the group listen to you? Ignore you?
7. Did you stay involved in the exercise or did you give up?
8. In what ways could you change or improve your interaction with others?

Evaluation: debrief and discuss these NASA solutions with the class. Discuss the process of consensus.

Figure 6.7. *Group Summary Sheet.*

	Individual Predictions											Group Prediction
	1	2	3	4	5	6	7	8	9	10	11	
Box of matches												
Food concentrate												
50 ft. of nylon rope												
Parachute silk												
Portable heating unit												
Two .45 calibre pistols												
One case dehydrated pet milk												
Two 100 lb. tanks of oxygen												
Stellar map (of moon's constellations)												
Life raft												
Magnetic compass												
Signal flares												
First aid kit with injection needles												
Solar-powered FM receiver-transmitter												
5 gallons of water												

Figure 6.8. Key to "Group Survival Task"

You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200 mile trip. Below are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance for your crew in allowing them to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on through number 15, the least important.

Little or no use on moon	15 Box of matches
Supply daily food required	4 Food concentrate
Useful in tying injured together, help in climbing	6 50 ft. of nylon rope
Shelter against sun's rays	8 Parachute silk
Useful only if party landed on dark side	13 Portable heating unit
Self-propulsion devices could be made from them	11 Two .45 calibre pistols
Food, mixed with water for drinking	12 One case dehydrated pet milk
Fills respiration requirement	1 Two 100 lb. tanks of oxygen
A principal means of finding directions	3 Stellar map
CO_2 bottles for self-propulsion across chasms, etc.	9 Life raft
Probably no magnetic poles; useless	14 Magnetic compass
Distress call when line of sight possible	10 Signal flares
Oral pills or injection medicine valuable	7 First aid kit with injection needles
Distress signal transmitter, possible communication with mother ship	5 Solar-powered FM receiver-transmitter
Replenishes loss from sweating, etc.	2 Five gallons of water

The material in Figures 6.5-6.8 was developed by the National Aeronautics and Space Administration for use in classrooms. By contacting the Educational Programs Officer at your nearest regional NASA Center, you can receive information on a variety of other educational programs and workshops available to teachers. New programs are made available as new technology is developed.

An Experiment in Cooperation: Team learning is a powerful learning device that is often neglected because many students know cooperation only as cheating. Joint problem-solving requires legitimate giving and receiving of help.

Time involved: approximately 45 minutes.

Material needed: before class, prepare a set of squares and an instruction sheet for each five students. A set consists of five envelopes containing pieces of stiff paper cut into patterns that will form five 6" x 6" squares, as shown in Figure 6.14. Several individual combinations will be possible, but only one total combination. Cut each square into the parts "a" through "j", and lightly pencil in the letters. Then mark the envelopes A through E and distribute the pieces

Erase the small letters from the pieces and write instead the envelope letters A through E, so that the pieces can be easily returned for reuse. By using multiples of 3 inches, several combinations will form one or two squares. Only one combination will form five 6" x 6" squares.

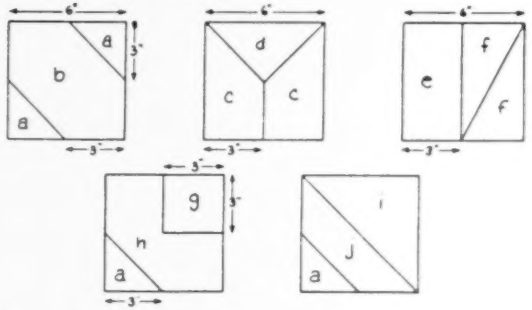


Figure 6.9. Materials for an Experiment in Cooperation.

Organizational pattern: divide the class into groups of five and seat each group at a table equipped with a set of envelopes and an instruction sheet. Ask that the envelopes be opened only on signal.

Teaching function: group facilitation, debriefing, and discussion leader.

Procedure: begin the exercise by asking what cooperation means. List on the board the behaviors required in cooperation. For example: everyone has to understand the problem; everyone needs to believe that he can help; instructions have to be clear; everyone needs to think of the other person as well as him or herself.

Describe the experiment as a puzzle that requires cooperation. Read the instructions aloud, point out that each table has a reference copy of the instructions, then give the signal to open the envelopes.

The instructions read as follows: (a) each person should have an envelope containing pieces for forming squares; (b) at the signal, the task of the group is to form five squares of equal size; (c) the task is not completed until everyone has before him a perfect square and all the squares are of the same size.

These are the rules: (a) no member may speak; (b) no member may ask for a card or in any way signal that he wants one; (c) members may give cards to others.

When all or most of the groups have finished, call time and discuss the experience. Ask such questions as: How did you feel when someone held a piece and did not see the solution? What was your reaction when someone finished his square and then sat back without seeing whether his solution

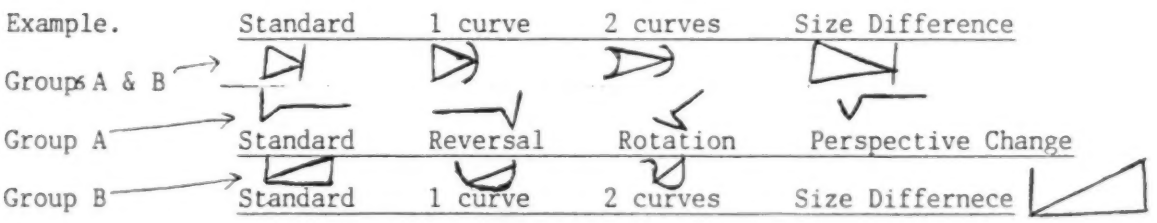
Handout #9

Replicating Anne Pick's Experiment on "Distinctive Features"

1. Divide the class into two groups. Group A in the experimental condition will be presented with the same 5 "standard" forms with the test distinctive features being different than the ones they learned in the learning situation. Group B in the experimental condition will be presented with 5 different "standard" forms with the test distinctive features being the same as they learned in the learning situation.

2. Either design, or get a hold of, about 50 different letter-like forms such as . Make use of lines, curves, loops, diagonals, half-circles, etc. For each of these 59 forms that will become your "standards" or "training" form, devise 3 variations along the following dimensions:

1 curve, 2 curves, size difference. ⟶ Group B
Reversal, Rotation, Perspective Change. ⟶ Group A



3. Present a selected standard form to the entire class. Decide what the distinctive features are. Present a variety of forms until most of the class can correctly choose the correct standard form, or until they get the idea. Repeat this exercise several times.

4. Next, divide the class into Group A and Group B, having each group cluster in a different part of the room.

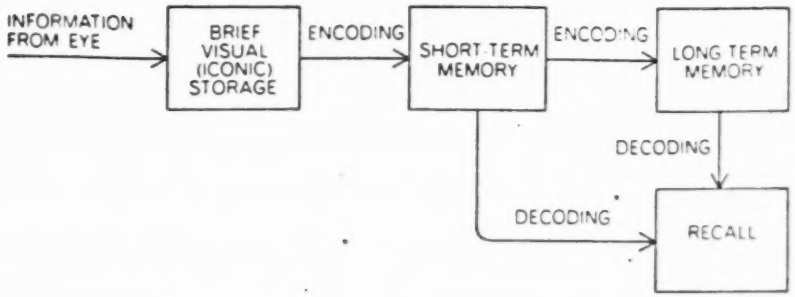
Group A will be presented with the same initial 5 forms in the previous training session. However, instead of using 1 curve, 2 curves, size difference as identifying distinctive features — substitute rotation, reversal, and perspective change. Have students keep track of how many times they can correctly identify the standard form they learned previously.

Group B will be presented with 5 different forms than in the training session, but with the same identifying distinctive features — 1 curve, 2 curves, size difference. Have students keep track of their correct identification scores.

5. Groups A & B will report their mean scores to each other. Hypothetically, Group B should have a higher mean score, or higher incidence of correct identification of a new form based on the same training distinctive features. Group A has a lower mean score because although using the same training forms, they were deprived of their originally learned distinctive features. They are unable to make as many correct identifications because their identifying mechanisms - distinctive features - has been changed.

This experiment demonstrates that we identify symbols, ie. letters, by learning what are the distinctive features of that letter or symbol. Our identification accuracy decreases when the distinctive features are not truly distinguishing; that is, they are unstable or unreliable.

Handout #10 - Memory Process



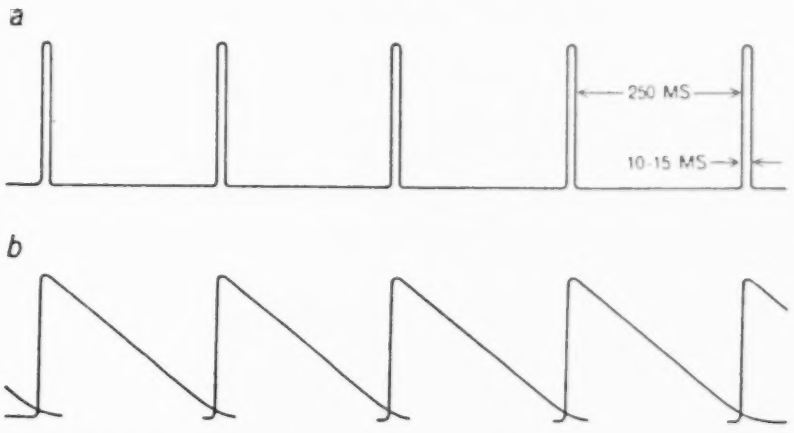
MEMORY PROCESS for words, numbers and other linguistic material has several stages. At left information such as a printed word seen by the eye is briefly stored as it actually looks. While this visual image lasts the word can be scanned, even if the original stimulus has disappeared. At center, during scanning, the word is encoded into its name (the letters *c*, *a* and *t* may become the word "cat") and is then entered in the short-term memory. At right the word enters the long-term memory, perhaps by being encoded again, this time from its name into its meaning. At lower right word is recalled by being decoded into its name.

the information in recallable form at this point, although the information may have to be coded back into names if it is to be recalled. The evidence does not yet indicate whether awareness of seeing the stimulus is synonymous with the iconic storage or short-term memory, or is something that happens with or after semantic coding.

This model of the linguistic memory process is a rather generalized one. Many specific models have been proposed, and the experimental evidence is not yet complete enough to choose between them. Nevertheless, several recent experiments have clarified what happens in the early stages. One problem that was investigated was the source of the errors that are made when an individual is asked to recall several items in a large display. Do such omissions indicate a limited memory capacity or are they due to a failure to perceive some of the items?

It is known that only four to six items can be remembered without the aid of rehearsal or recoding. Thus it seems possible that whereas all the objects might have been perceived at first, some were simply lost because there was no room for them in the short-term memory. Items might also be lost at later stages in the memory process.

How could these hypotheses be tested? How, in other words, could failure to perceive be experimentally distinguished from some limitation of memory capacity? One cannot solve the problem merely by asking the subject if he saw every item in the display when it was first perceived. If a subject's memory capacity is too limited to contain all the items in a display, he will not be able to recall whether or not he perceived each of them initially.



VISUAL IMAGE in an observer's memory makes a flash of light appear to persist after it has actually faded. In one experiment demonstrating such persistence a subject watched a train of flashes, each lasting between 10 and 15 milliseconds and spaced 250 milliseconds apart. In *a* flashes are represented by peaks. In *b* the images excited by the flashes are represented by curves indicating how the flashes looked to subject. The curves show that a visual image is excited by each flash (*sharply rising phase*). This image persists in the memory, fading gradually over 250 milliseconds so that it outlasts the flash itself. Because one image is still perceptible when the next image begins (*intersections of falling and rising curves*) flashes appear to subject to blend into each other, forming a flickering train.

An experimental approach to this problem, developed a century ago by N. Baxt, was rediscovered by George Sperling of the Bell Telephone Laboratories. In one of Sperling's experiments based on Baxt's method the subject was presented with an array of letters in a tachistoscope. The array remained visible for about 50 milliseconds. Once the display ended, the subject was asked to remember all the letters until a marker appeared that indicated the position of from one to four of the letters that he was to report. If there was no delay, that is, if the indicator came on immediately after the termination of the display, the subject made virtually no errors. This period of error-free reporting lasted for approximately 250 milliseconds (a quarter of a second). As the delay between the end of the display and the appearance of the indicator increased, however, so did the frequency of the subject's errors.

Some important conclusions about the memory process and the source of the errors can be drawn from these results. If recall is perfect at the instant after the tachistoscopic flash of the array ends, it follows that nearly all the information in the display has probably been stored in the memory. If the storage were not virtually complete, the subject would be unable to recall some items because those indicated for report are selected randomly. There is accordingly no way for the subject to remember only those items to be selected for recall.

It can also be concluded from the highly accurate recall that the initial perception, that is, the image conveyed by the visual system to the memory system, must itself be accurate. If perception were not detailed and inclusive, the iconic image in the memory would contain errors and so would the recall. The initial perception, then, cannot be the source of the errors.

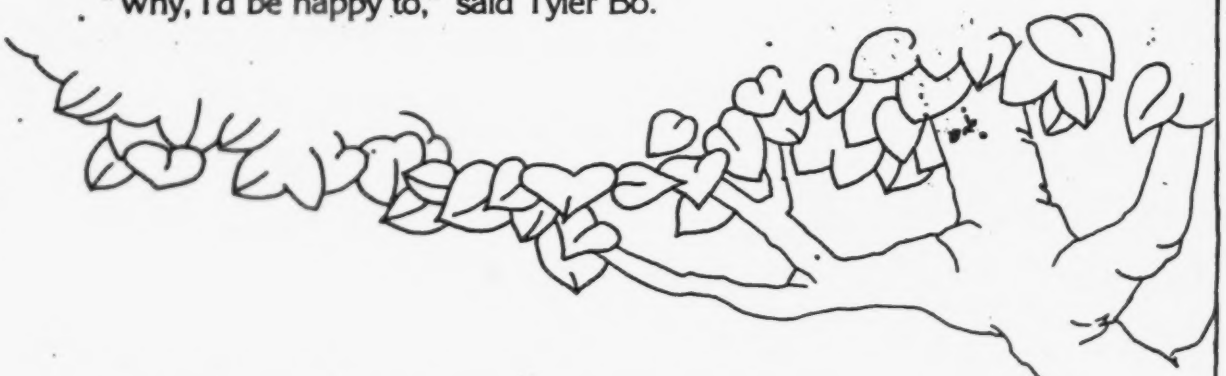
Since the subject is never asked to report more than four items, a quantity within the capacity of the short-term memory, the errors and omissions subjects make when they try to recall items from a large display must apparently originate in the later processing stages of the memory, not in the initial iconic-

From "How We Remember What We See," Ralph Norman Haber, May 1970. 53

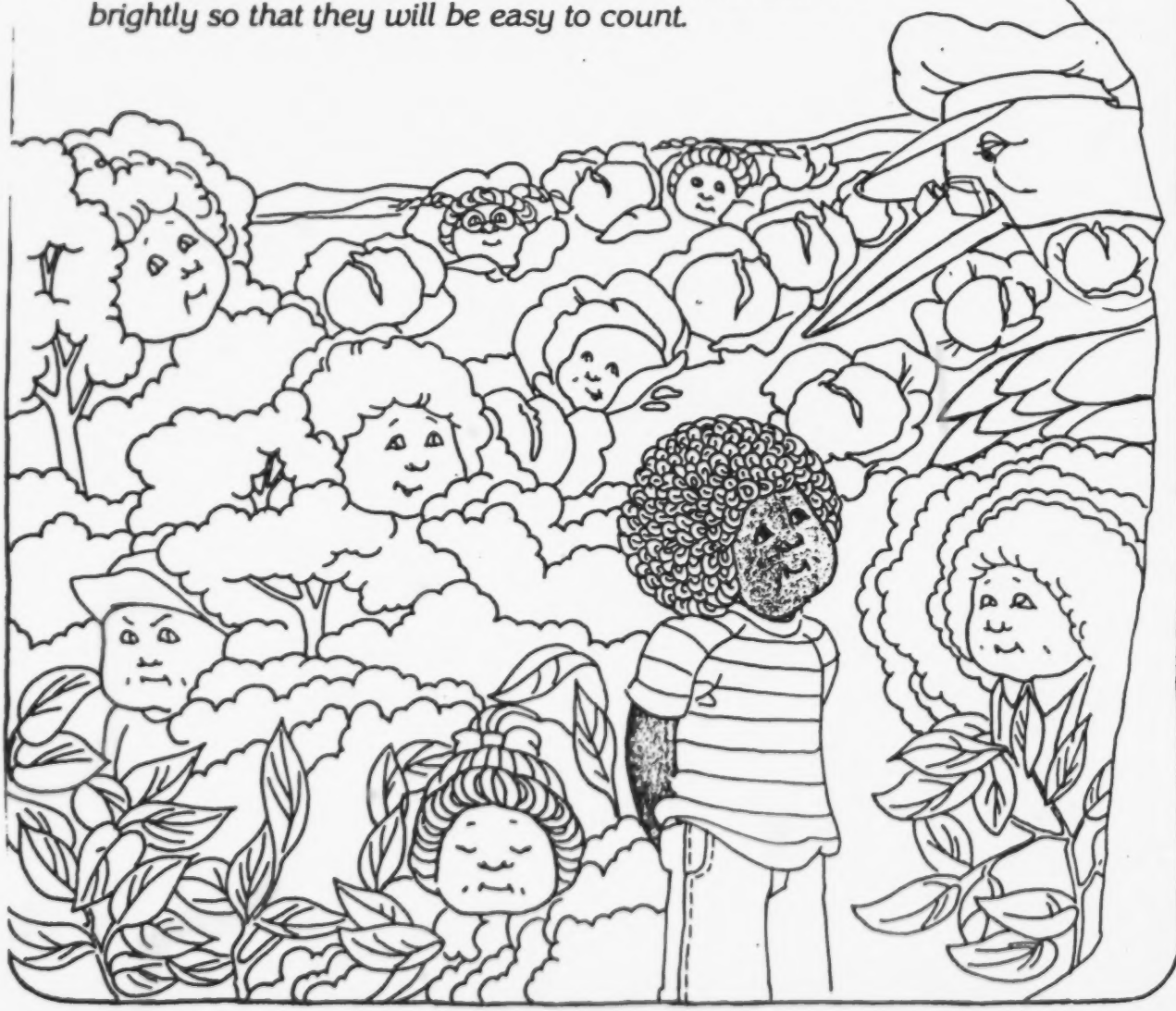
Figure-Ground - Handout #11

"Tyler Bo, I have a problem, and I think you can help me," said Colonel Casey. "You're so good with numbers and all. Could you help me keep track of how many 'Kids are in the Cabbage Patch?" he asked. . .

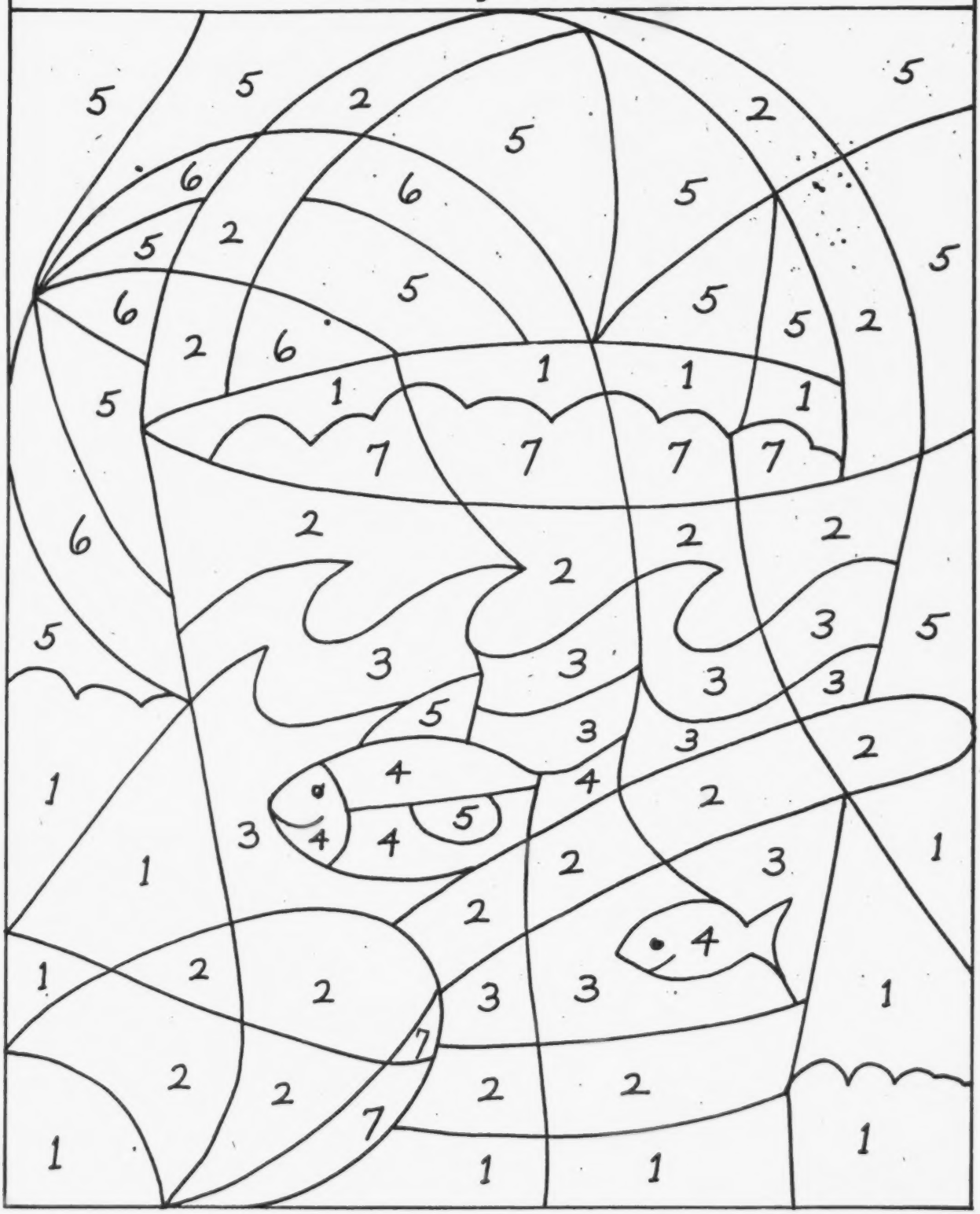
. "Why, I'd be happy to," said Tyler Bo.



Find all the Cabbage Patch Kids and color them brightly so that they will be easy to count.



Color by Number



1-tan 2-gray 3-blue 4-orange 5-yellow
6-red 7-brown

Handout #11 - Word Puzzle (Figure-Ground)

55 JANE AUSTEN 55

Can you find all these characters created by Jane Austen, one of th greatest British novelists?

Solution on page 7

- ☐ Elizabeth BENNET
- ☐ Captain BENWICK
- ☐ Sir Thomas BERTRAM
- ☐ Mr. BINGLEY
- ☐ Colonel BRANDON
- ☐ Frank CHURCHILL
- ☐ Mrs. CLAY
- ☐ William COX
- ☐ Henry CRAWFORD
- ☐ Admiral CROFT
- ☐ Fitzwilliam DARCY
- ☐ Elinor DASHWOOD
- ☐ Anne ELLIOT
- ☐ Augusta ELTON
- ☐ Jane FAIRFAX
- ☐ Mrs. FERRARS
- ☐ Mrs. GARDINER
- ☐ Dr. GRANT
- ☐ Mrs. HURST
- ☐ Charlotte LUCAS
- ☐ Mary MUSGROVE
- ☐ Mr. PALMER
- ☐ Lieutenant PRICE
- ☐ Mr. RUSHWORTH
- ☐ Lady RUSSELL
- ☐ Harriet SMITH
- ☐ Lucy STEELE
- ☐ Isabella THORPE
- ☐ General TILNEY
- ☐ Maria WARD
- ☐ Mr. WICKHAM
- ☐ John WILLOUGHBY
- ☐ Emma WOODHOUSE
- ☐ Mr. YATES

L	M	A	R	T	R	E	B	X	A	F	R	I	A	F
U	T	S	R	U	H	T	F	C	Y	U	R	Y	E	F
C	Y	E	N	L	I	T	R	E	S	A	E	R	L	A
A	P	R	I	C	E	A	R	S	R	L	L	G	E	L
S	E	T	A	Y	W	V	E	O	G	R	R	C	E	M
A	N	F	H	F	L	L	O	N	W	A	A	O	T	E
E	A	O	O	T	L	L	I	R	N	H	R	R	S	R
S	E	R	D	Y	I	B	I	T	G	E	S	K	S	D
U	D	C	C	N	E	M	O	H	N	S	C	U	T	C
O	O	R	T	L	A	I	S	I	C	I	U	O	R	O
H	A	O	T	H	L	R	D	O	W	R	A	M	X	W
D	T	O	K	L	E	R	B	N	H	U	U	R	N	H
O	N	C	E	E	A	N	E	E	P	R	O	H	T	S
O	I	N	L	G	O	B	E	N	N	E	T	E	C	A
W	I	L	L	O	U	G	H	B	Y	A	W	A	R	D

40 Handout #11 ADVERTISING Word Puzzle 40

(Figure-Ground)

The origins of advertising go back to the earliest times. Archeologists found an outdoor advertisement for rental property in Roman ruins and a painted wall directing travelers to a tavern in ancient Pompeii.

Solution on page 81

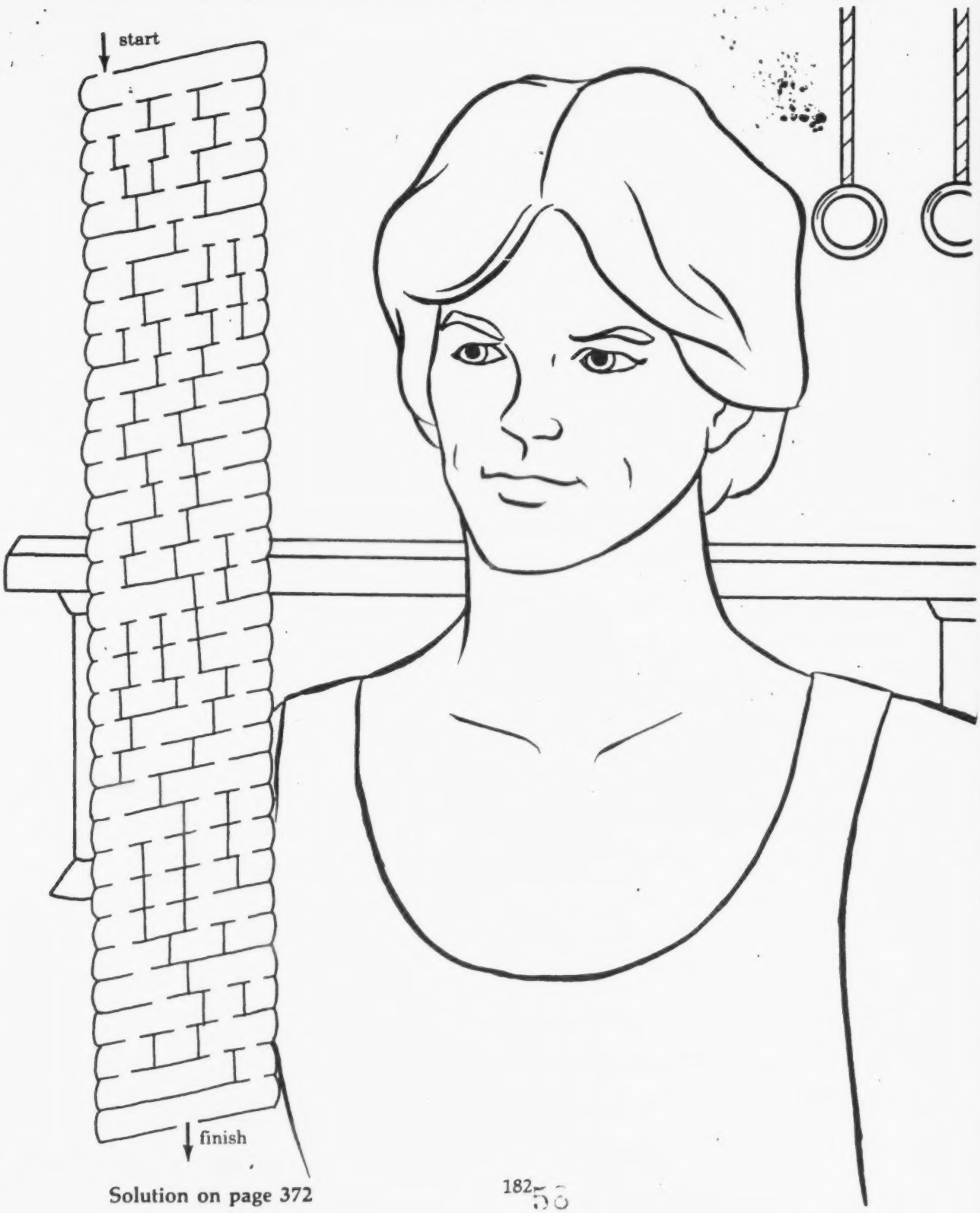
ACCEPT	☐ LEAFLET
ACTION	☐ LISTEN
ADVERTISE	☐ LOCAL
AMUSE	☐ MAIL
ANNOUNCE	☐ MARKET
APPEAL	☐ MEDIA
AWARE	☐ MEDIUM
BILLBOARD	☐ MESSAGE
BRAND	☐ MODEL
BUSINESS	☐ NAME
BUYER	☐ NEED
CARDS	☐ NEON
CATALOGS	☐ NOTIFY
CIRCULATION	☐ POINT OF VIEW
CLASSIFIED	☐ POSTER
CLIENT	☐ PRINTS
COMFORTABLE	☐ PUBLIC
COMMUNICA-TION	☐ RADIO
CONSUMER	☐ READ
COST	☐ SALE
CUSTOMS	☐ SEEK
DESCRIBE	☐ SEEN
DESIRE	☐ SELECT
DIRECT	☐ SELL
DISPLAY	☐ SHAPE
DISTRIBUTING	☐ SHOP
DOLLARS	☐ SIGNS
ENJOY	☐ SKETCH
EXPOSE	☐ SKYWRITING
FILMED	☐ SPONSOR
FLASH	☐ SUGGEST
FOLDER	☐ SURVEY
HABIT	☐ TELEPHONE
HANDBILL	☐ TELEVISION
HEARD	☐ THEME
IDEAS	☐ TRADEMARK
IMPACT	☐ URGE
IMPROVED	☐ WORD OF MOUTH
INTEREST	☐ WORK

L	Y	F	N	N	Z	J	E	L	M	N	P	Y	S	Q	O	K	S	U
I	A	N	O	E	N	M	D	D	O	N	X	H	C	N	R	R	T	R
X	G	C	K	E	E	S	E	I	O	R	O	S	N	O	P	S	A	Q
H	W	R	O	D	K	S	T	I	V	P	B	Z	W	M	O	D	E	L
T	N	E	I	L	C	A	T	A	L	O	G	S	W	C	I	O	T	V
H	S	A	S	R	L	C	U	A	E	E	C	N	U	O	N	N	A	P
R	A	D	I	U	A	C	O	M	M	U	N	I	C	A	T	I	O	N
Q	L	B	C	F	S	E	B	E	A	P	P	E	A	L	O	D	Y	M
T	E	R	I	E	S	P	H	D	N	O	U	H	E	K	F	E	L	S
P	I	G	N	T	I	T	C	A	S	G	B	F	G	J	V	A	N	M
C	H	C	O	M	F	O	R	T	A	B	L	E	R	R	I	S	D	O
I	N	E	T	S	I	L	E	F	I	I	B	J	Y	E	R	B	T	
N	E	J	I	L	E	R	L	L	E	S	C	S	R	G	W	M	R	S
A	P	K	F	M	D	Y	L	A	X	B	E	T	A	E	C	A	A	U
D	A	G	Y	O	Z	B	U	S	I	N	E	S	S	T	D	I	N	C
V	H	E	N	J	O	Y	W	H	U	L	S	H	C	E	T	L	D	S
E	S	U	M	A	A	H	A	V	E	E	R	E	M	U	S	N	O	C
R	B	D	R	W	A	J	A	V	M	N	R	A	O	E	P	G	Q	F
T	E	D	A	O	P	K	I	N	M	I	R	R	L	K	D	N	S	R
I	L	R	E	R	I	S	E	D	D	K	M	D	E	M	L	I	F	Z
S	E	E	I	D	I	S	T	R	I	B	U	T	I	N	G	T	U	B
E	C	N	A	O	E	S	O	P	X	E	I	N	P	N	S	I	A	M
F	T	I	N	F	I	L	Y	G	N	O	T	L	S	Q	U	R	T	C
S	G	M	H	M	L	S	U	G	G	E	S	T	L	R	C	W	T	Y
I	M	P	R	O	V	E	D	P	R	D	I	S	P	L	A	Y	C	D
U	R	A	M	U	H	C	T	E	K	S	M	P	M	A	R	K	E	T
B	Z	C	V	T	N	F	S	O	S	R	A	L	L	O	D	S	L	I
S	A	T	Q	H	X	T	E	L	E	P	H	O	N	E	S	V	E	X
T	W	C	I	D	H	E	J	K	G	L	S	G	W	F	H	E	S	J

Hand out #12 - Maze

Rope Climb

Jeff is ready to practice rope climbing. Help him by completing this maze.

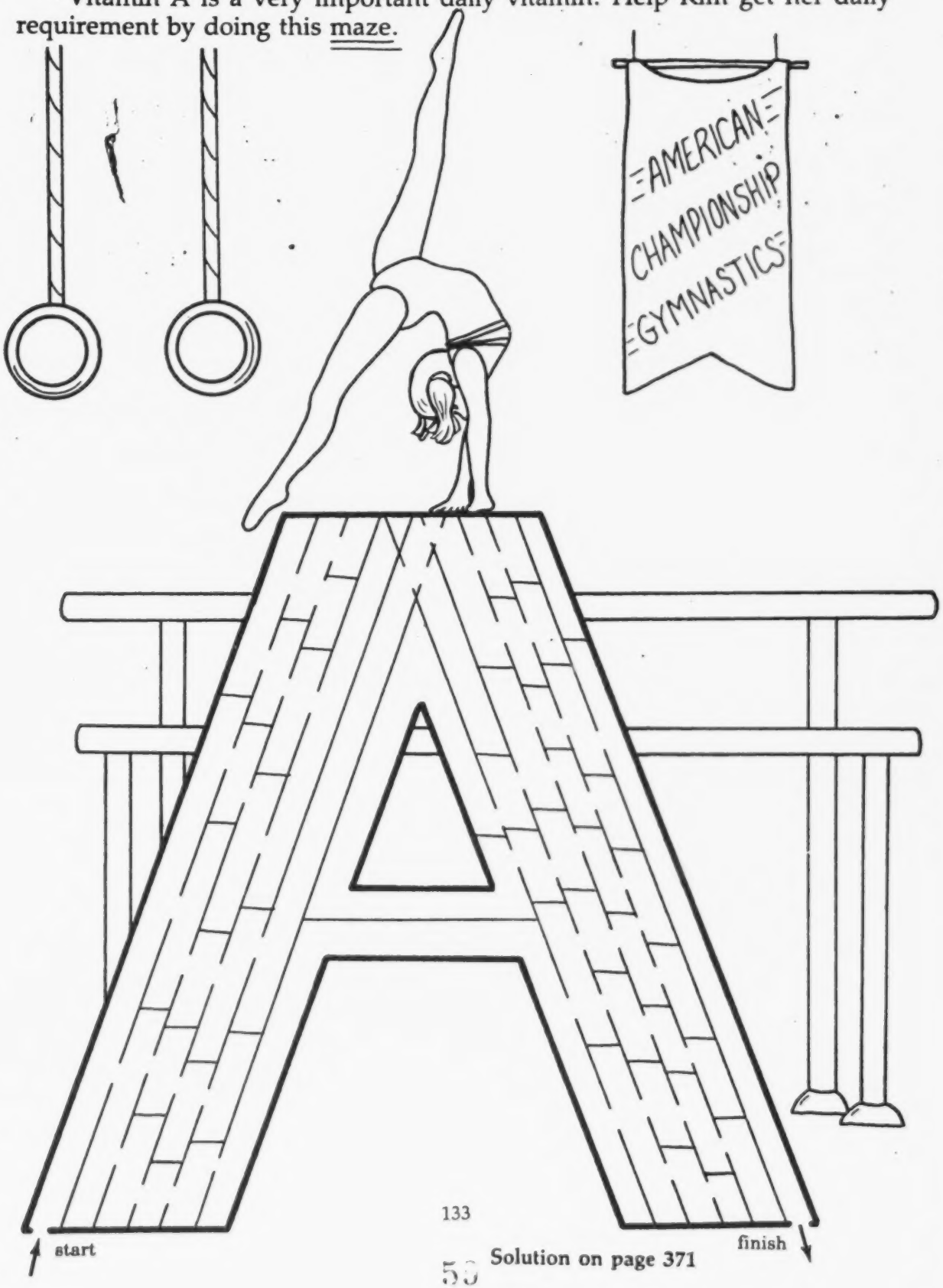


Solution on page 372

Essential Vitamin

Hand out #12 - Maze

Vitamin A is a very important daily vitamin. Help Kim get her daily requirement by doing this maze.



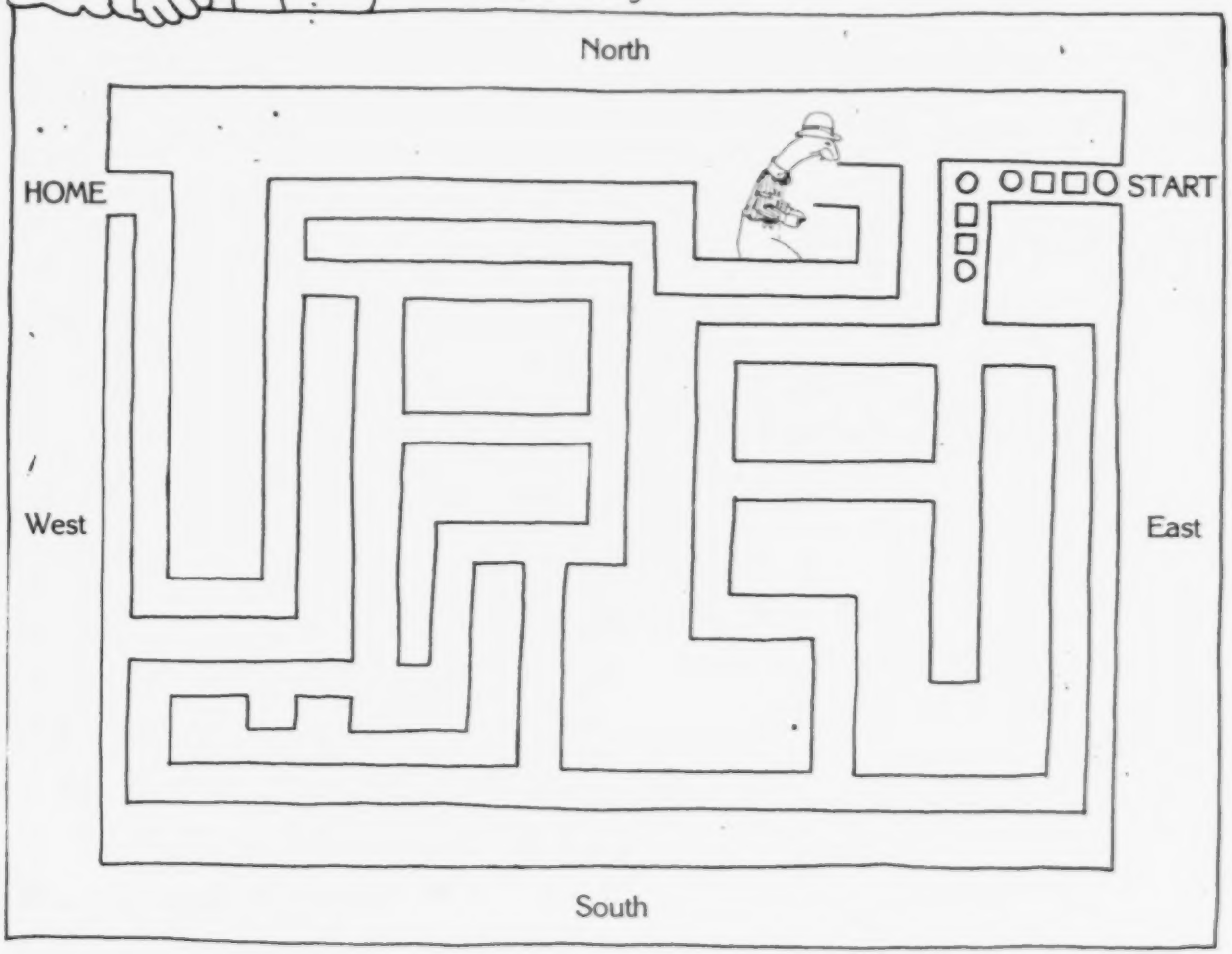
Solution on page 371

Handout #13 - Tracking

"Now, to find our way home," said Tyler Bo.

"The compass will help us. I remember that the "high place" was east of the Cabbage Patch, so we must head west to get back."

Tracking



Follow these directions and use your pencil to make the route on this map:

1. *Head east.*
2. *Head south.*
3. *Head west.*
4. *Turn north at second road.*
5. *Turn west.*
6. *Turn south.*
7. *Head west.*
8. *Head north.*
9. *Head west.*
10. *Head south.*
11. *Head west.*
12. *Head north.*
13. *Head west.*
14. *YOU'RE HOME!!!*

Handout #14

Exploration of the Tactile Sense/Imaging Exercise

EXPLORATION OF THE TACTUAL SENSE

Our brain is never in direct contact with the world. It comes to know & understand external reality only through the information that our senses send it.

The tactual sense is an extremely important one but often overlooked in teaching/learning. The tactual sense underlies and supports visual perception. It is important for other reasons as well. Through our sensory examination and exploitation we build internal models or "images" to represent the world and the objects and events with it.

ACTIVITIES WHICH EXPLORE TACTUAL PERCEPTION

Drawing/describing hidden objects

--Description Choose 4 - 6 objects that present a range of tactual experience. One object should be unfamiliar but small enough to fit entirely within the hand. Another object should be familiar and "hand size." One object should incorporate diagonal lines. Another object should be unfamiliar by label and by function and larger than hand size. Another object may be 3-dimensional, unfamiliar, and so large that it requires that the individual feel of the object and remember what touch told him in order to draw it.

--Procedure The student feels for the hidden object placed in a bag and draws what he feels. Record the individual's language and response to the task. Save the drawings!

Imaging Exercise

Follow directions under Activities Which Explore Tactual Perception to set up this activity. Have class divide up into teams of two. Each team will get a brown paper sack with 4-6 objects. Students take turns in feeling objects, describing them verbally to their partner, and drawing them. When each student has had a chance to feel, image, and draw the objects, then they may look inside the bag.

Collect all the pictures and put them under the "Visual Imaging" exhibit in the classroom. Discuss the reactions to this exercise, how the students approached this task, what kinds of images they had, and how they used their other senses like touching to help them draw the object without seeing it.

A variation of this activity would be to play a musical selection, and let the students record and/or draw their imagery. A variety of scents could be made available, and students could record and/or draw what comes to mind, etc. The teacher could have a variety of textures and surfaces available as well.

Handout #15

Summing It Up

Intelligence (end-product of learning) is the ability to learn.
Creativity is the highest form of learning.

The House of learning is the Brain.

The Brain's Messengers or Contact People are our 5 senses.
(See, Hear, Taste, Touch, Smell)

The 5 Senses Work with the Brain's Staff or neurons.

The Staff (neurons or nerve cells) + the Messengers or Investigators or Contact People (5 Senses) = Perception (how we accomplish learning).

Perception is based upon the meaning and understanding of the world to us.

We use our perceptions to help us learn. We identify things by their DISTINCTIVE FEATURES. We store this information in our memories. The information in our memories is used to construct images, or pictures, in our minds. These pictures help us to remember our perceptions better. The more we can remember about our perceptions, the better we are able to learn about our world.

Handout #16 - Use It or Lose It

From Magical Child, Joseph Chilton Pearce, EP Dutton, NY, 1977.

like a muscle atrophying, if they are not developed along with the rest of our faculties. They must become part of overall logical development, continually reinterpreted according to maturation. Logical maturation should act on the conceptual structuring of primary perceptions, just as it does on all learning, and these capacities should grow accordingly. Our perceiving of the primary process is always subject to our general conceptual ability. A primary perception suddenly breaking in on the awareness of an adult long out of touch with this aspect of life would be as disorienting as vision flooding the system of the congenitally blind. As a result, once our primary perceiving has atrophied, our self system develops a kind of defense against any such disorientation, locking us pretty tightly into our social consensus.

The primary process is ordinarily quite selective, drawing on the field of awareness according to the needs of the particular individual. As physicist Robert Jeffries pointed out several years ago, telepathy most often takes place between persons with close emotional ties. Telepathy with one's own child is therefore quite easy to establish and develop. Jeffries suggests that a family practice telepathic communication right before sleep and right after waking, starting with simple targets and working toward complexity. Again, the problem is conceptual: learning to pattern information from the primary process, learning to cue properly and attend the often subtle forms the perceptions take.

By selectivity, I mean the kind of attending found in Dr. Tart's telepathic experiment. Subject A's primary process gave clear body signals of the moment when subject B was shocked. Out of the multitude of possibilities within the general field of awareness, the process chose according to the request made from the individual self system, even though that self system did not know how to open to the answer. Here again, we find the real thrust and meaning of individuation and its role in the hologram possibilities of life: The unique and separated self, with its volitional system and capacity to choose, selects some target from the primary process, or plays with some possibility out of a continuum of possibilities (see Chapter 15). The primary process responds to volition and furnishes the result. Dr. Tart requested certain information; the primary process responded with clear perceptions.

Shortly after one of my sons turned four, I noticed his interest in and aptitude for music, so I started him on piano studies. He sat in my lap at the keyboard, I placed his hands on mine, and we "did notes." I used little verbal instruction, but we sang our notes as we played them. With one hand, we pointed to the note on the page; with the other, we played the note, switched hands as needed, up and down, rhythmically swinging through page after page and then book after book of "little fingers" music, one-note-

at-a-time stuff, which was just my speed. Before long, I simply took my hands out from under his, and he was doing notes, singing descriptions, swinging along. It was fun. For the first year, we played together that way; then autonomy took over, and he sat alone. By then, he had left my one-note stumbles behind, and I placed him with a Julliard graduate who concertized in our area. By age five and a half, he could read almost anything his hands could encompass. He had perfect pitch and wrote tunes while sitting in his window seat. He would sing them to us, go back, harmonize them in neat classical triads, go to the piano, and play his finished piece. By age six, he played Bach, Clementi, and Bartok with astonishing skill, ease, and sophistication. His hands coordinated perfectly, his sight-reading was superb, and he memorized almost immediately. His teacher and I could never understand how he knew classical harmony intuitively, nor how any of his skill had unfolded so rapidly.

By the time he was seven, however, he faltered. We had started him in private school at five. He quickly became a fine reader and an all-round splendid student. And the more he became immersed in reading, to the great applause of parents and teachers, the more rapidly his music collapsed. By eight, his coordination was gone, his superb reading ability was gone, he no longer had perfect pitch, and he no longer wrote pieces.

A number of factors had entered at age four: The rudiments of individuation had given the possibility of creative relations between self and primary process. Our extremely close rapport had given a mutual exchange, our own form of psychological communication. In spite of my lack of keyboard skill, I had extensive musical study and experience. All this had acted as a strong stimulus to my son's similar leanings. The primary process shared between us had this immediate continuum of possibilities on which to draw. His learning was kept completely within the category of play, and because that play involved, for the first year, actually sitting in my lap, the entire venture took place in the safe confines of the bond. Performance or learning was not the issue, stress and anxiety were avoided, and so he learned at a remarkable rate. He played, and the absorbent mind characteristic of that period worked beneath the surface, exactly as the two systems, play and work, are designed to do. (In Chapter 18, I will explore how this synchrony is split by schooling, in which the self is not allowed to play but must try to do the work, wrecking the marvelous balance of forces involved in learning.)

Primitive peoples often exhibit a fine sense of balance between volitional choice and primary process in their learning. Farley Mowat, a Canadian biologist, relates the story of how an Eskimo friend of his, the "minor shaman" Ootek, gained an uncanny knowledge of and rapport with wolves.[4]

Handout #17 - Hebrew Text

נשמת

נִשְׁמַת כָּל חַי תְּבָרֵךְ אֶת שִׁמְךָ יהוה אֱלֹהֵינוּ, וְרוּחַ כָּל בָּשָׂר תְּפָאֵר וּתְרוֹמֵם זִכְרְךָ מַלְכֵּנוּ תָּמִיד. מִן הָעוֹלָם וְעַד הָעוֹלָם אַתָּה אֵל, וּמִבַּלְעָדֶיךָ אֵין לָנוּ מֶלֶךְ גּוֹאֵל וּמוֹשִׁיעַ, פּוֹדֶה וּמַצִּיל וּמְפַרְנֵס וּמְרַחֵם בְּכָל עֵת צָרָה וְצוּקָה. אֵין לָנוּ מֶלֶךְ אֶלָּא אָתָּה. אֱלֹהֵי הָרִאשׁוֹנִים וְהָאַחֲרוֹנִים, אֱלוֹהַּ כָּל בְּרִיּוֹת. אֲדוֹן כָּל תּוֹלָדוֹת, הַמְהֻלָּל בְּרֹב הַתִּשְׁבָּחוֹת, הַמְנַהֵג עוֹלָמוֹ בְּחֶסֶד וּבְרִיּוֹתָיו בְּרַחֲמִים. וַיהוה לֹא יָנוּם וְלֹא יִישָׁן, הַמְעוֹרֵר יְשֵׁנִים, וְהַמֵּקִיץ נִרְדָּמִים, וְהַמֵּשִׂיחַ אִלְּמִים, וְהַמַּתִּיר אֲסוּרִים, וְהַסּוֹמֵךְ נוֹפְלִים, וְהַזּוֹקֵף כְּפוּפִים, לְךָ לְבַדְּךָ אֲנַחְנוּ מוֹדִים.

אִלּוּ פִינוּ מָלֵא שִׁירָה כַּיָּם
וּלְשׁוֹנֵנוּ רִנָּה כַּהֲמוֹן גַּלָּיו
וְשִׂפְתוֹתֵינוּ שֶׁבַח כְּמֶרְחֲבֵי רָקִיעַ
וְעֵינֵינוּ מְאִירוֹת כַּשֶּׁמֶשׁ וְכַיָּרֵחַ
וְיָדֵינוּ פְרוּשׂוֹת כְּנִשְׁרֵי שָׁמָיִם
וְרַגְלֵינוּ קַלּוֹת כָּאַיָּלוֹת
אֵין אֲנַחְנוּ מַסְפִּיקִים לְהוֹדוֹת לְךָ, יהוה אֱלֹהֵינוּ וֵאלֹהֵי אֲבוֹתֵינוּ, וּלְבָרֵךְ אֶת שִׁמְךָ עַל אַחַת מֵאֶלֶף אַלְפֵי אֲלָפִים וְרִבֵּי רְבָבוֹת פְּעָמִים הַטּוֹבוֹת שֶׁעָשִׂיתָ עִם אֲבוֹתֵינוּ וְעִמָּנוּ.

מִמִּצְרַיִם גְּאַלְתָּנוּ, יהוה אֱלֹהֵינוּ, וּמִבֵּית עֲבָדִים פְּדִיתָנוּ, בְּרָעָב זַנְתָּנוּ, וּבְשָׂבָע כִּלְכַּלְתָּנוּ, מֵחֶרֶב הִצַּלְתָּנוּ, וּמִדֶּבֶר מִלַּטְתָּנוּ, וּמֵחֳלָיִם רָעִים וְנֶאֱמָנִים דִּלִּיתָנוּ. עַד הֵנָּה עֲזָרוּנוּ רַחֲמֶיךָ, וְלֹא עֲזָבוּנוּ חֲסָדֶיךָ, וְאַל תִּטְּשֵׁנוּ, יהוה אֱלֹהֵינוּ, לָנֶצַח. עַל כֵּן, אֵבָרִים שֶׁפִּלַּגְתָּ בָּנוּ, וְרוּחַ וּנְשָׁמָה שֶׁנָּפַחְתָּ בְּאַפֵּינוּ, וְלָשׁוֹן אֲשֶׁר שַׂמְתָּ בְּפִינוּ, הֵן הֵם יוֹדוּ וִיבָרְכוּ וִישַׁבְּחוּ וְיפָאֲרוּ וִירוֹמְמוּ וְיַעֲרִיצוּ וְיַקְדִּישׁוּ וְיַמְלִיכוּ אֶת שִׁמְךָ

Nishmat

Nishmat are as
, as old as the
ıip is obscure,
:d to different
; them Shimon
nan-scholar of
a. Every Shab-
tov, this soar-
ayer and praise
nagogue. And
recited every-
f all faiths join
ı extolling the
.

The breath of all that lives praises You, Adonai, our God. The force that drives all flesh exalts You, our King, always. Transcending space and time, You are God. Without You we have no other to rescue and redeem us, to save us and sustain us, to show us mercy in disaster and distress. God of all ages, God of all creatures, ceaselessly extolled, You guide the world with kindness, its creatures with compassion. God neither slumbers nor sleeps. You stir the sleeping, support the falling, free the fettered, raise those bowed down and give voice to the speechless. You alone do we acknowledge.

Could song fill our mouth as water fills the sea,
And could joy flood our tongue like countless waves,
Could our lips utter praise as limitless as sky,
And could our eyes match the splendor of the sun,
Could we soar with arms like eagle's wings,
And run with the gentle grace of swiftest deer,
Never could we fully state our gratitude
For one ten-thousandth of the lasting love
Which is Your precious blessing, dearest God,
Granted to our ancestors and us.

From Mitzrayim You redeemed us, from the house of bondage You delivered us. In famine You nourished us, in prosperity You sustained us. You rescued us from the sword, protected us from pestilence and saved us from severe and lingering disease. To this day Your compassion has helped us, Your kindness has not forsaken us. Never abandon us, Adonai our God. These limbs which You formed for us, this soul-force which You breathed into us, this tongue which You set in our mouth, must thank, praise, extol, exalt and sing Your holiness and sovereignty. Every mouth shall thank You, every tongue shall pledge

From Passover Haggadah Feast of Freedom, Edited by Rachel Anne Rabinowicz, published by the Rabbinical Assembly, USA, 1982.

Handout #18-French Text

plus rigoureux des derniers aux circonstances motivant cette union. Les « indices » propres à ce stade permettent une prévision qui commence à se détacher de l'action propre : il y a donc là également tout à la fois application des schèmes connus aux situations nouvelles et progrès dans l'adaptation aux données de la perception. Il en est de même des « explorations » dont nous venons de parler. Sans doute la dernière de ces conduites ne suppose-t-elle pas nécessairement de coordinations entre des schèmes distincts : elle n'implique que l'application des schèmes à des objets nouveaux. Mais, de même que les premières, elle comporte une accommodation réelle du schème à l'objet, et non plus seulement une application globale comme au troisième stade.

67

CHAPITRE V

LE CINQUIÈME STADE :

LA « RÉACTION CIRCULAIRE TERTIAIRE » ET LA « DÉCOUVERTE DES MOYENS NOUVEAUX PAR EXPÉRIMENTATION ACTIVE »

Au cours du troisième des stades que nous avons distingués, l'enfant a construit, en manipulant les choses, une série de schèmes simples dus à la « réaction circulaire secondaire », tels que « secouer », « frotter », etc. Ces schèmes, tout en ne se coordonnant point encore les uns avec les autres, comportent pourtant chacun une organisation des mouvements et des perceptions, et, par conséquent, un début de mise en relation des objets entre eux. Mais cette organisation, demeurant intérieure à chaque schème, n'implique pas de distinction nette entre « moyens » et « fins », et cette mise en relation, pour la même raison, reste toute pratique et ne conduit point à l'élaboration d'« objets » proprement dits.

Au cours du quatrième stade, qui précède immédiatement celui-ci, les schèmes secondaires se coordonnent entre eux et donnent ainsi naissance aux actions complexes que nous avons dénommées « applications des moyens connus aux circonstances nouvelles ». Cette coordination des schèmes, qui différencie nettement les « moyens » et les « fins » et caractérise ainsi les premiers actes d'intelligence proprement dite, assure une nouvelle mise en relations des objets entre eux et marque donc le début de la constitution des « objets » réels. Mais deux circonstances limitent l'efficacité de ce comportement et définissent du même coup la différence qui le sépare de ceux du cinquième stade. En premier lieu, pour s'adapter aux circonstances nouvelles dans lesquelles il se trouve, c'est-à-dire pour écarter l'obstacle ou découvrir l'intermédiaire voulu, l'enfant du quatrième stade se

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borne à coordonner entre eux des schèmes déjà connus, quitte à les différencier par accommodation progressive en les ajustant ainsi les uns aux autres. En second lieu, et par cela même, les relations que l'enfant établit entre les choses dépendent encore de schèmes déjà tout faits et dont la coordination seule est nouvelle : aussi n'aboutissent-elles pas à l'élaboration d'objets entièrement indépendants de l'action, ni de « groupes » spatiaux entièrement « objectifs », etc. C'est ce que nous verrons, en particulier, au cours du volume II, en étudiant les notions de l'objet, de l'espace, de la causalité et du temps caractéristiques du quatrième stade. En bref, le quatrième stade, en tant que défini par le début de la coordination des schèmes, apparaît plus comme une phase d'initiation ou de gestation que comme une période de réalisation ou d'accomplissement.

Le cinquième stade, au contraire, dont nous abordons maintenant l'étude, est avant tout le stade de l'élaboration de l'« objet ». Il est caractérisé, en effet, par la constitution de nouveaux schèmes dus, non plus à la simple reproduction des résultats fortuits, mais à une sorte d'expérimentation ou de recherche de la nouveauté comme telle. D'autre part, et en corrélation avec cette même tendance, le cinquième stade se reconnaît à l'apparition d'un type supérieur de coordination des schèmes : la coordination dirigée par la recherche de « moyens » nouveaux.

Or, l'une et l'autre de ces deux conduites prolongent celles des stades précédents. Pour ce qui est de la « réaction circulaire tertiaire », elle dérive directement, ainsi que nous le verrons, des réactions secondaires et des « explorations » auxquelles ces dernières donnent finalement lieu : la seule différence est que dans le cas des réactions « tertiaires » l'effet nouveau obtenu fortuitement n'est pas seulement reproduit, mais modifié dans le but d'en étudier la nature. Quant aux « découvertes de moyens nouveaux par expérimentation active », elles couronnent simplement la coordination des schèmes déjà en usage durant le quatrième stade, mais l'ajustement réciproque des schèmes, que nous avons décrit au cours du chapitre précédent, devient accommodation pour l'accommodation, c'est-à-dire recherche de procédés nouveaux.

Mais si les comportements du cinquième stade prolongent ceux du quatrième, et en constituent ainsi l'aboutissement naturel, ils n'en marquent pas moins un progrès décisif et le début d'une phase réellement caractéristique. En effet, pour la première fois, l'enfant s'adapte vraiment aux situations inconnues, non pas seulement en utilisant les schèmes acquis antérieurement, mais en cherchant et en trouvant des moyens nouveaux. D'où

une série de conséquences en ce qui concerne, d'une part, le fonctionnement de l'intelligence, et, d'autre part, les catégories essentielles de la pensée concrète.

Du premier de ces points de vue, la coordination des schèmes s'accompagnant dorénavant d'accommodation intentionnelle et différenciée aux circonstances nouvelles, on peut dire que le mécanisme de l'intelligence empirique est définitivement constitué : l'enfant est capable dorénavant de résoudre les problèmes nouveaux, même si aucun schème acquis n'est directement utilisable à cet effet, et si la solution de ces problèmes n'est pas encore trouvée par déduction ou représentation, elle est assurée en principe dans tous les cas grâce au jeu combiné de la recherche expérimentale et de la coordination des schèmes.

Quant aux « catégories réelles » de la pensée, une telle accommodation aux choses, jointe à la coordination des schèmes déjà acquise durant le stade précédent ont pour effet de détacher définitivement l'« objet » de l'activité propre tout en l'insérant dans des groupes spatiaux cohérents, ainsi que dans des séries causales et temporelles indépendantes du moi.

§ 1. LA RÉACTION CIRCULAIRE TERTIAIRE. — Le propre des conduites que nous allons décrire maintenant est de constituer, pour la première fois, un effort pour saisir les nouveautés en elles-mêmes.

Certes, dès les débuts de la vie mentale, on peut dire que le milieu extérieur impose aux réactions du sujet un élargissement constant et que l'expérience nouvelle fait sans cesse craquer les cadres anciens. C'est pourquoi aux schèmes réflexes se superposent tôt ou tard les habitudes acquises et à celles-ci les schèmes d'intelligence. Et, certes, on peut dire également que le sujet accepte avec plaisir cette nécessité, puisque la « réaction circulaire » à tous ses niveaux, est précisément un effort pour conserver les nouveautés et les fixer par assimilation reproductrice. En troisième lieu, on peut soutenir en un sens que la nouveauté naît de l'assimilation elle-même, puisque les schèmes hétérogènes, il est vrai, mais peu nombreux, qui sont donnés au début, tendent à s'assimiler réciproquement et conduisent ainsi aux multiples combinaisons des coordinations, soit inter-sensorielles soit intelligentes.

Mais, considérés sous un autre angle, les mêmes faits montrent ainsi la résistance de la vie mentale à la nouveauté et la victoire momentanée de la conservation sur l'accommodation. C'est ainsi que le propre de l'assimilation est de négliger ce qu'il y a de nouveau dans les choses et les événements pour les réduire

Handout #19

Nonsense Language

The dibbit ilked the orambim in the clustild because the orambim zooked the dibbit.

1. Who ilked the orambim?
2. Why did the dibbitt ilk the orambim?
3. Where did the dibbitt ilk the orambim?
4. What did the orambim do to the dibbitt?
5. Do you think the orambim and the dibbitt are friends? Why or why not?

Note: We tend to make sense out of nonsense. We can attach meaning to the above because it follows the pattern of our own language. Notice the importance of the prepositions. Now, try the next exercise.

Queksor and Ulifant were crockers. Queksor and Ulifant crocked a nosh-whopper. Elker and elker they crocked to mim the dork. Flimly, Queksor litched because an idder kilded on his junket. Ulifant litched too. Queksor and Ulifant litched up the nosh-whopper.

1. What did Queksor and Ulifant do?
2. What did they crock?
3. How did they crock to mim the dork?
4. Why did Queksor litch?
5. What happened after Queksor litched?
6. What did Queksor and Ulifant do to the nosh-whopper?

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